

# Popular Science

JUNE • 1962 • 35¢ *Monthly*

Complete Guide to Engine  
Options for Your New Car

---

All About Those Hot New  
Inboard/Outboards

---

Win Arguments with PS's  
Arsenal of What's Biggest,  
Fastest, Most Powerful



# 13 Ways to Multiply Your Muscle Power



# Get Lucky

the taste to start with...the taste to stay with



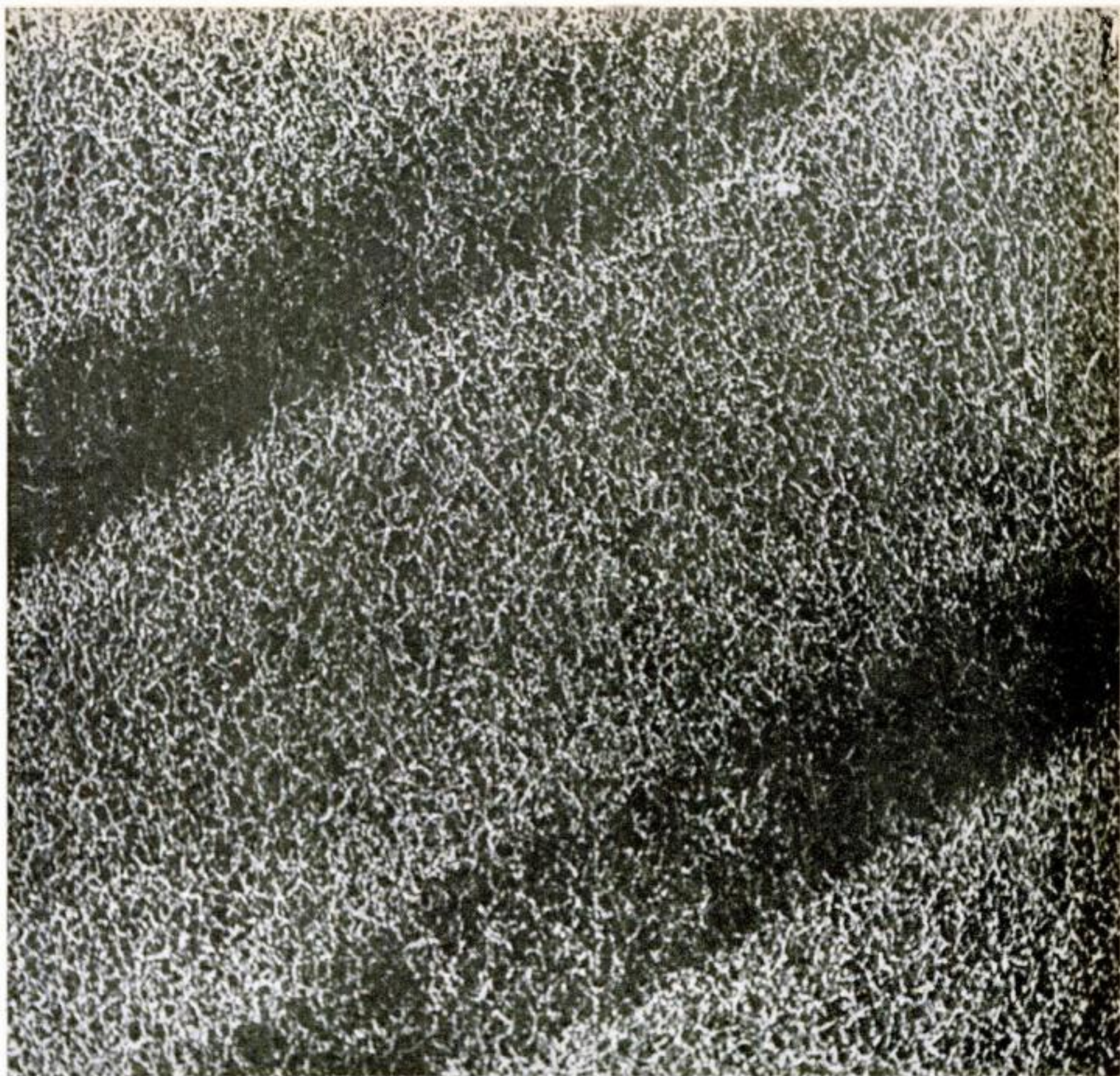
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# Popular Science

Mechanics and Handicraft ®  
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June 1962

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When an astronaut, speeding at 17,500 m.p.h., breaks out of orbit to return to earth, he needs an awesome braking system to lower his capsule—powerful retrorockets and big parachutes. See page 45 for the story.

## SPACE AND AVIATION

How to Get Down from 100 Miles Up • 45

Satellite to Put Europe on TV • 72

Balloons Harden in Space • 92

## CARS AND DRIVING

Rambler Is Champ in Economy Run • 12

Avanti: Hot New Studey • 55

Horsepower or Economy? • 58

Why My Second Car Is a Pickup • 83

What's New for Your Car • 162

Hints from the Model Garage • 164

Gus Puts In a Plug for Teen-Agers • 168

## SCIENCE AND INVENTIONS

How to Seem to Know Everything • 64

Growing Human Life in the Lab • 74

The Boat You Sail on Sand • 86

Multiply Your Muscle Power • 94

## ELECTRONICS: RADIO, HI-FI, TV, KITS

All About FM Stereo • 78

What's New in Electronics • 155

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## HOME AND SHOP

- [Amazing Facts About Chains • 98](#)
- [A Homemade Panel Saw • 110](#)
- [Blowtorch Foundry Furnace • 114](#)
- [Fix-It File: Venetian Blinds • 119](#)
- [Make Your Own Teeter-Go-Round • 122](#)
- [Compact Camping Kitchen • 124](#)
- [Buggy-Top Garage Door • 126](#)
- [Vertical Chain Saw for Carpentry • 134](#)
- [How to Make a Sign Like a Pro • 138](#)
- [One Machinist Tells Another • 146](#)
- [Battery Tools for Outdoor Chores • 149](#)
- [What's New in Tools • 160](#)

## PHOTOGRAPHY

- [How Cameras Catch Crooks • 50](#)
- [Umbrella—for Picture Taking • 68](#)
- [Roving-Eye Camera Gives 3-D • 128](#)
- [Convert a Sink to Wash Prints • 129](#)
- [Tips from the Gadget Bag • 130](#)
- [What's New in Photography • 152](#)

## BOATS AND MOTORS

- [Afloat in a Paper Boat • 61](#)
- [Inside the Inboard-Outboards • 105](#)
- [Working with Canvas • 115](#)
- [When Your Boat Goes Aground • 142](#)
- [What's New in Boating • 154](#)

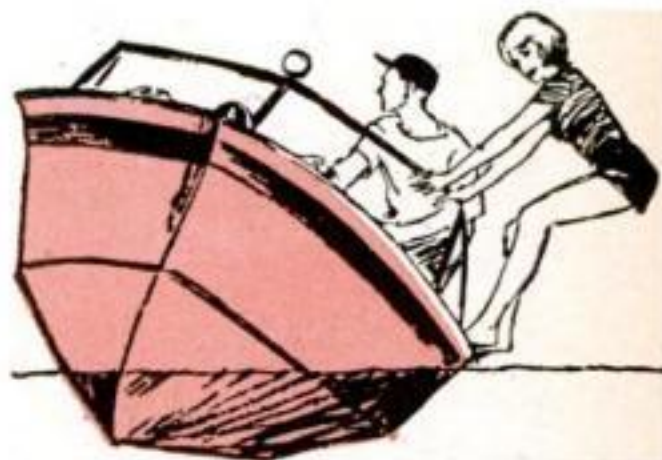
## SHORT CUTS AND TIPS

- [Notching Linoleum or Tile • 121](#)
- [Drinking Fountain for a Pooch • 127](#)
- [How to Improve Contact Prints • 127](#)
- [Hanger for a Garden Hose • 136](#)
- [Water Pot for a Grinder • 137](#)
- [Gauge Scribes Centerline • 148](#)
- [Pen Rack for Drawing Board • 176](#)

## EVERY MONTH

- [PS Readers Talk Back • 4](#)
- [The March of Science • 19](#)
- [Detroit Report • 35](#)
- [I'd Like to See Them Make • 71](#)
- [New Ideas from the Inventors • 89](#)
- [The Other Fellow's Job • 102](#)
- [Wordless Workshop • 132](#)

POPULAR SCIENCE **90<sup>th</sup>** YEAR



*Gone aground? Don't get out the distress rockets before you've read this advice from a boating expert on how to use simple tricks (above: heeling) to get you safely on your way. Page 142.*

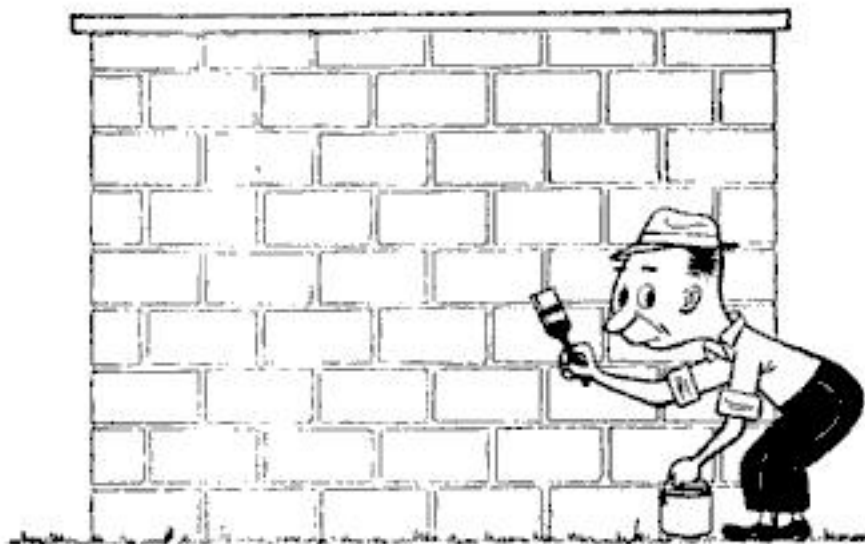


*To shoot a pretty girl—or to handle many other tricky photo-lighting problems—an umbrella may be the answer. Details about the technique on page 68.*

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# PS readers talk back



## Fall-in on Fallout

If the emission from a radioactive particle can affect an atom, surely it must have polarity. If it has polarity, then why isn't it amenable to electrostatic, electromagnetic, or magnetic control? Yet the only defense ever mentioned for fallout is buffer control—atomic density between you and the particles.

If you painted a structure with conductive paint (electrically above ground) and connected the negative terminal of a 90-volt battery to this coating with the positive terminal to ground, would this offer any advantage in a fallout area? I await your answer—conductive-paintbrush in hand!

JOSEPH T. HARRIS, Lubbock, Tex.

*Most dangerous radiation comes in the form of gamma rays, which are electrically neutral. They would be no more affected by electrical or magnetic devices—or conductive coatings—than light rays are. Fallout also emits beta rays—electrons—which are electrically charged. But they're so easily stopped by any material (even air or clothing) that more complicated shielding is unnecessary.*

## PS Takes a Bow

It is my pleasure to inform you that the National Safety Council's Public Interest Award for Exceptional Service to Safety in 1961 has been granted to POPULAR SCIENCE MONTHLY. We believe you are doing an important job for safety and we are delighted that the judges have seen fit to recognize this fact.

## Rambler Series

You say that PS took delivery of a two-door Rambler American custom job. But the equipment described belongs only to the "400" line. Am I right?

WILLIS R. BOTTGER, Oklahoma City.

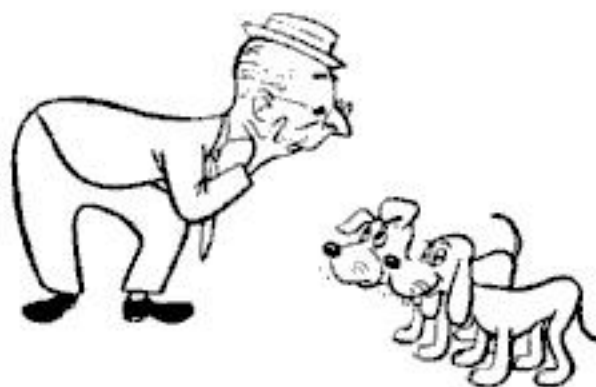
*Right!*

## Scientists and Evolution

The man with the fuzzy opinion on evolution ["PS Readers Talk Back," Mar., p. 10] was answered 40 years ago. A resolution of the American Association for the Advancement of Science, meeting on Dec. 26, 1922, has this to say: "There is no ground whatever for the assertion that these evidences [of the evolution of plants and man] constitute a mere guess . . . No scientific generalization is more strongly supported by thoroughly tested evidence than that of organic evolution."

ROBERT REEDER, Walkerton, Ind.

. . . Evolution is so evident that it is not a theory, as the "atomic theory" still is. The evidence for evolution is large enough to be seen with the naked eye—just look at any two



dogs, or at any two people. To state that something that can be seen is less reasonable than something that cannot is distinctly fallacious.

PROF. ROBERT G. SCHIFF

So. Illinois Univ., Carbondale.

## Tipping Him Off

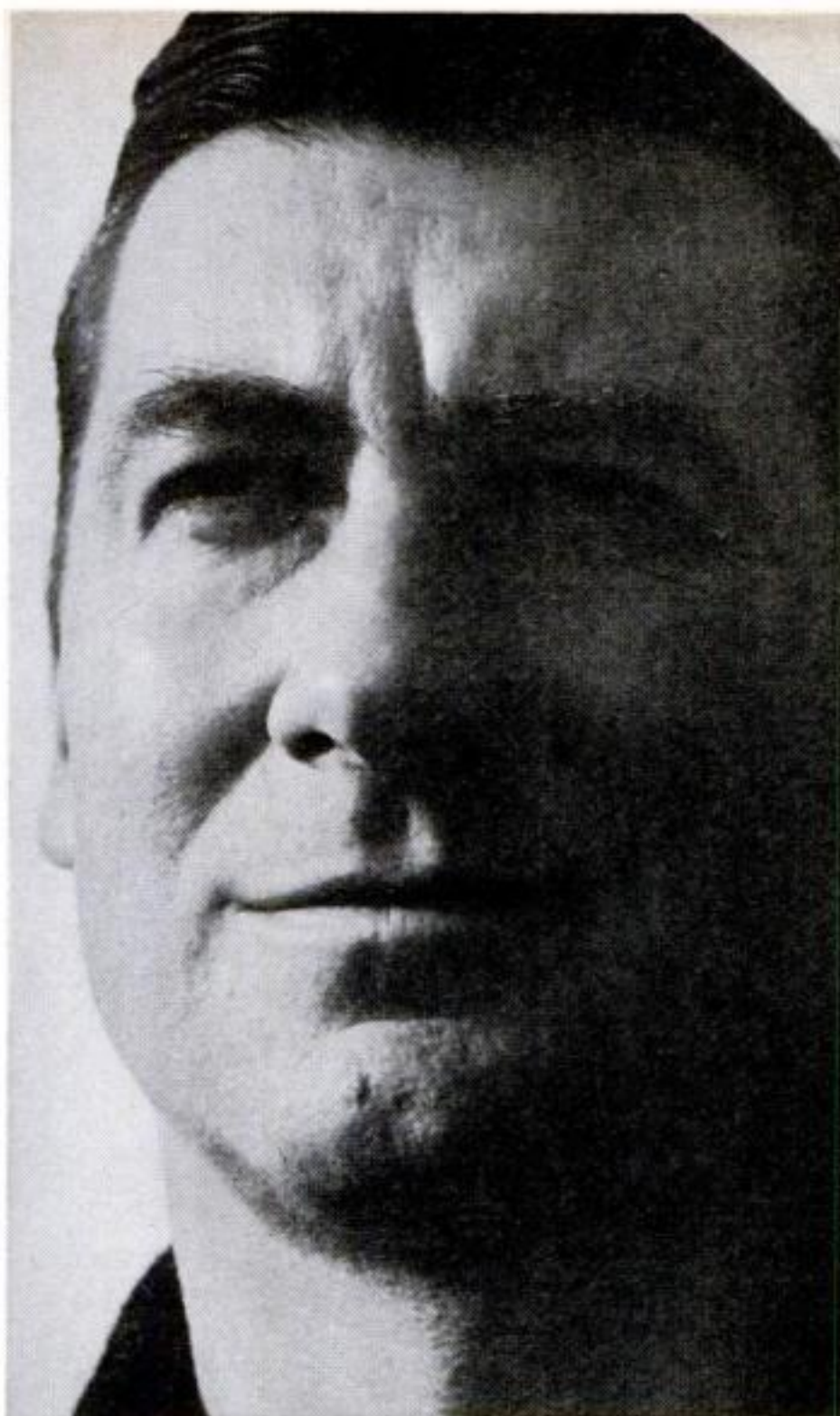
In "Hints from the Model Garage" [Mar., p. 178], there's a tip for using a neon-tube tester to make sure an engine-block heater is running. You say that if the tester lights, you have current. You do have current through the tester; but if the heater is defective, the tester

We hope you feel, as we do, that there is another dividend as a result of your safety efforts—the knowledge that you have helped prevent many accidents.

HOWARD PYLE, President  
National Safety Council, Chicago.

*This brings to a full dozen the display of National Safety Council plaques awarded to PS over the last 12 years.*





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- ☐ Arch. Drawing and Designing
- ☐ Building Contractor
- ☐ Building Estimator
- ☐ Carpenter Builder
- ☐ Carpentry and Millwork
- ☐ Heating
- ☐ Painting Contractor
- ☐ Plumbing
- ☐ Reading Arch. Blueprints

### ART

- ☐ Commercial Art
- ☐ Magazine Illus.
- ☐ Sign Painting and Design'g
- ☐ Sketching and Painting

### AUTOMOTIVE

- ☐ Automobile
- ☐ Auto Body Rebuilding and Refinishing
- ☐ Auto Engine Tuneup
- ☐ Auto Electrical Technician
- ☐ Diesel Engines

### AVIATION

- ☐ Aero-Engineering Technology
- ☐ Aviation Engine Mech.
- ☐ Reading Aircraft Blueprints

### BUSINESS

- ☐ Accounting
- ☐ Advertising
- ☐ Bookkeeping and Cost Accounting
- ☐ Business Administration
- ☐ Business Management
- ☐ Clerk Typist
- ☐ Creative Salesmanship
- ☐ Managing a Small Business
- ☐ Professional Secretary
- ☐ Public Accounting
- ☐ Purchasing Agent
- ☐ Real Estate Salesmanship
- ☐ Salesmanship
- ☐ Salesmanship and Management
- ☐ Traffic Management

### CHEMICAL

- ☐ Analytical Chemistry
- ☐ Chemical Engineering
- ☐ Chem. Lab. Technician
- ☐ General Chemistry

- ☐ Oil Field Technology
- ☐ Pulp and Paper Making

### CIVIL ENGINEERING

- ☐ Civil Engineering
- ☐ Construction Engineering
- ☐ Highway Engineering
- ☐ Professional Engineer (Civil)
- ☐ Reading Struc. Blueprints
- ☐ Sanitary Engineer
- ☐ Sewage Plant Operator
- ☐ Structural Engineering
- ☐ Surveying and Mapping
- ☐ Water Works Operator

### DRAFTING

- ☐ Aircraft Drafting
- ☐ Architectural Drafting
- ☐ Drafting & Machine Design
- ☐ Electrical Drafting
- ☐ Electrical Engineer Drafting
- ☐ Industrial Piping Drafting
- ☐ Mechanical Drafting
- ☐ Sheet Metal Drafting

### ELECTRICAL

- ☐ Electrical Appliance Servicing
- ☐ Electrical Engineering

- ☐ Electric Motor Repairman
- ☐ Elec. Engr. Technician
- ☐ Elec. Light and Power
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- ☐ Practical Lineman
- ☐ Professional Engineer

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- ☐ High School Science
- ☐ Short Story Writing

### LEADERSHIP

- ☐ Industrial Foremanship
- ☐ Industrial Supervision
- ☐ Personnel-Labor Relations
- ☐ Supervision

### MECHANICAL and SHOP

- ☐ Diesel Engines
- ☐ Gas-Elec. Welding
- ☐ Heating and Air Conditioning
- ☐ Industrial Engineering
- ☐ Industrial Instrumentation

- ☐ Industrial Safety
- ☐ Machine Shop Practice
- ☐ Mechanical Engineering
- ☐ Plumbing and Heating
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- ☐ Quality Control
- ☐ Reading Shop Blueprints
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- ☐ Tool Making

### RADIO, TELEVISION

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- ☐ Industrial Electronics
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- ☐ TV Technician

### RAILROAD

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### STEAM and DIESEL POWER

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- ☐ Stationary Diesel Engr.
- ☐ Stationary Steam Engines

### TEXTILE

- ☐ General

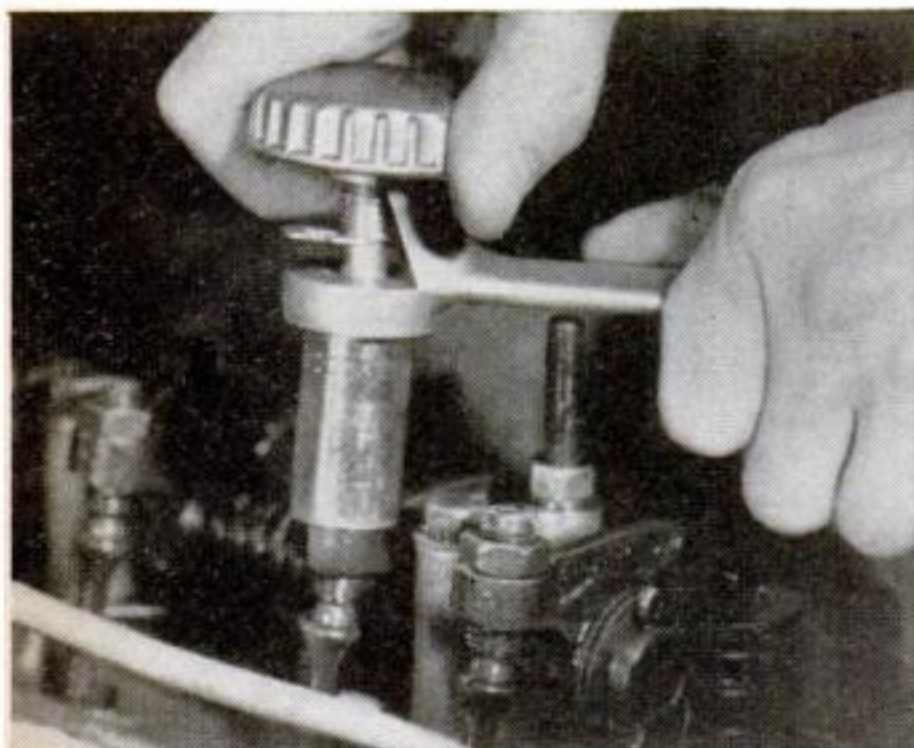
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## QUICK QUIZ BY QUAKER STATE

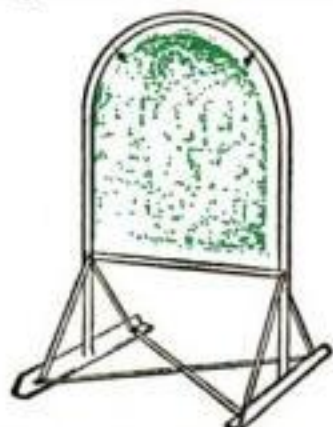


1. Can you identify this device?



2. What does this symbol stand for?

The device at top is a valve-lash adjuster. The life preserver stands for Quaker State Motor Oil—because it is the best engine life preserver. Refined from 100% pure Pennsylvania Grade Crude Oil, it keeps your car on the road, out of the repair shop—and saves you money. Always insist on Quaker State—the best engine life preserver.



QUAKER STATE OIL REFINING CORP., OIL CITY, PA.

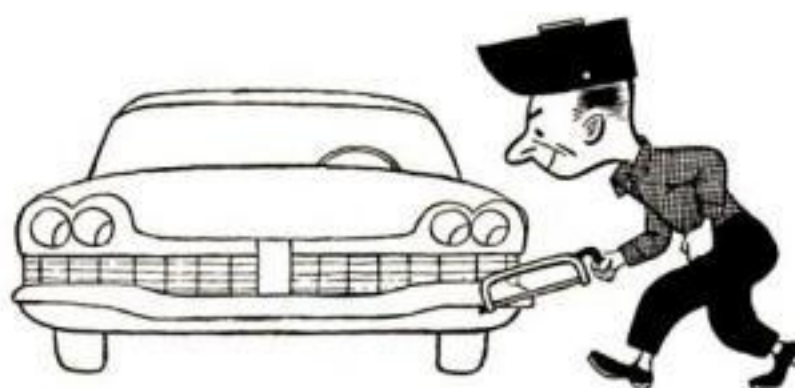
won't tell you whether current is flowing through it or not.

W. S. ST. ROMAIN, Chalmette, La.

*The tester is not intended as a trouble light. It merely lets you know at a glance whether the heater is plugged in.*

### Only as Good as the Weld

I notice that your editors who make road tests of cars (and writers here in Australia also) deplore the low-gear steering of American cars—known here as Yank Tanks. Well, sir, I own a 1959 Plymouth which had five turns from lock to lock. What I did with it I'll be happy to pass along to the Detroit moguls for what it's worth:



I removed the pitman arm, hacksawed it in two, and welded in  $\frac{3}{8}$  inches (one hour's work). Result: four turns from lock to lock, no appreciable increase in manual effort, and much more control in the event of a rear breakaway. That  $\frac{3}{8}$  inch was the maximum I could put in and still clear the oil pan. Other cars may be able to take a little more.

E. EDISON WATERS, Victoria, Aus.

*Cutting and welding the linkage is an old way to "quicken" slow steering. But inevitably it exacts a penalty in steering effort. And it should be attempted by no one unwilling to trust his life—and the lives of others—to the quality of the weld.*

### Current Controversy

You say that opening one leg of the center-tapped filament of a 12AU7 ["Fixing TV's Dead Heats," Mar., p. 151] will burn out this tube because all the heater current will try to flow through. I say voltage on the other pin is not increased, so current flow will be the same through that leg as it was originally. One filament leg would go out (not burn out), and no flare or any such nonsense would occur.

H. L. HARRINGTON, University Park, Pa.

*No, sir. When one leg of the parallel filaments is open, resistance of the tube filament is doubled. This increase in resistance causes less current to flow in the entire filament string (Ohm's law). A lower current results in a smaller voltage drop across the other tubes in the string, leaving a higher voltage to be dropped across the filament with the higher resistance.*

*Another way to look at it: Suppose this were*

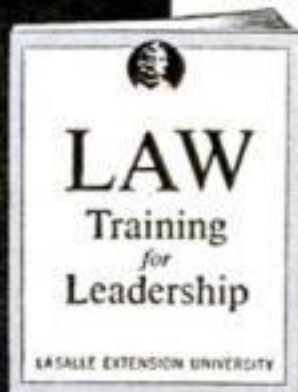
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a constant-current circuit. If you double the resistance by opening one of the parallel legs, you double the voltage drop across the tube.

### Lowering the Boom

I enjoyed "The Big Boom in Sailboarding," [Mar., p. 138]. It is a tremendous experience when, gliding across the water, you feel (as you say) the weirdly silent, sudden surge of



power. It is my dream to own a sailboard.

Your writer speaks of two methods of control—the tiller for steering and the mainsheet rope for setting the sail angle. After three years of sailing instruction, may I pass some along? There are no ropes on any sailboat; there are "lines."

GAIL LEWIS, Rockford, Ill.

... In the diagram showing what sailboards can do [p. 142], one label says: "Running: Sail far out, slams over hard at midpoint of the

turn." I have had five years of training in sailing and have experienced little or no boom banging. If the jibe is done properly, it can be as smooth as coming about. If done in a heavy wind, of course, you may end up with damage to the mast.

I appreciate your boating section and hope for more on sailboards.

D. H. SMITH, Wilmington, Del.

### No Yakety-Yak on CB

I read the piece on Citizens Band ["The Radio Party Line," Feb., p. 139] and would like to know how you put out a general call on CB. As I understand it, you can't put out a call resembling a CQ, or call an unknowing station. I have a walkie-talkie and would love to call a CQ on 11 meters.

CRAIG DEBBAN, N. Hollywood, Calif.

According to FCC regulations for the 27-mc. Citizens Band, a general call is permissible only in cases of dire emergency. But it is permissible to put out a general call directed at a specific group. For example, if you need information about a particular event, you may put out a call to anyone who knows anything about it. In effect, you're calling that group of CBers who know about this event, place, or person. This does not permit you to call CQ on 11 meters for amateur-radio-type "ragchewing."



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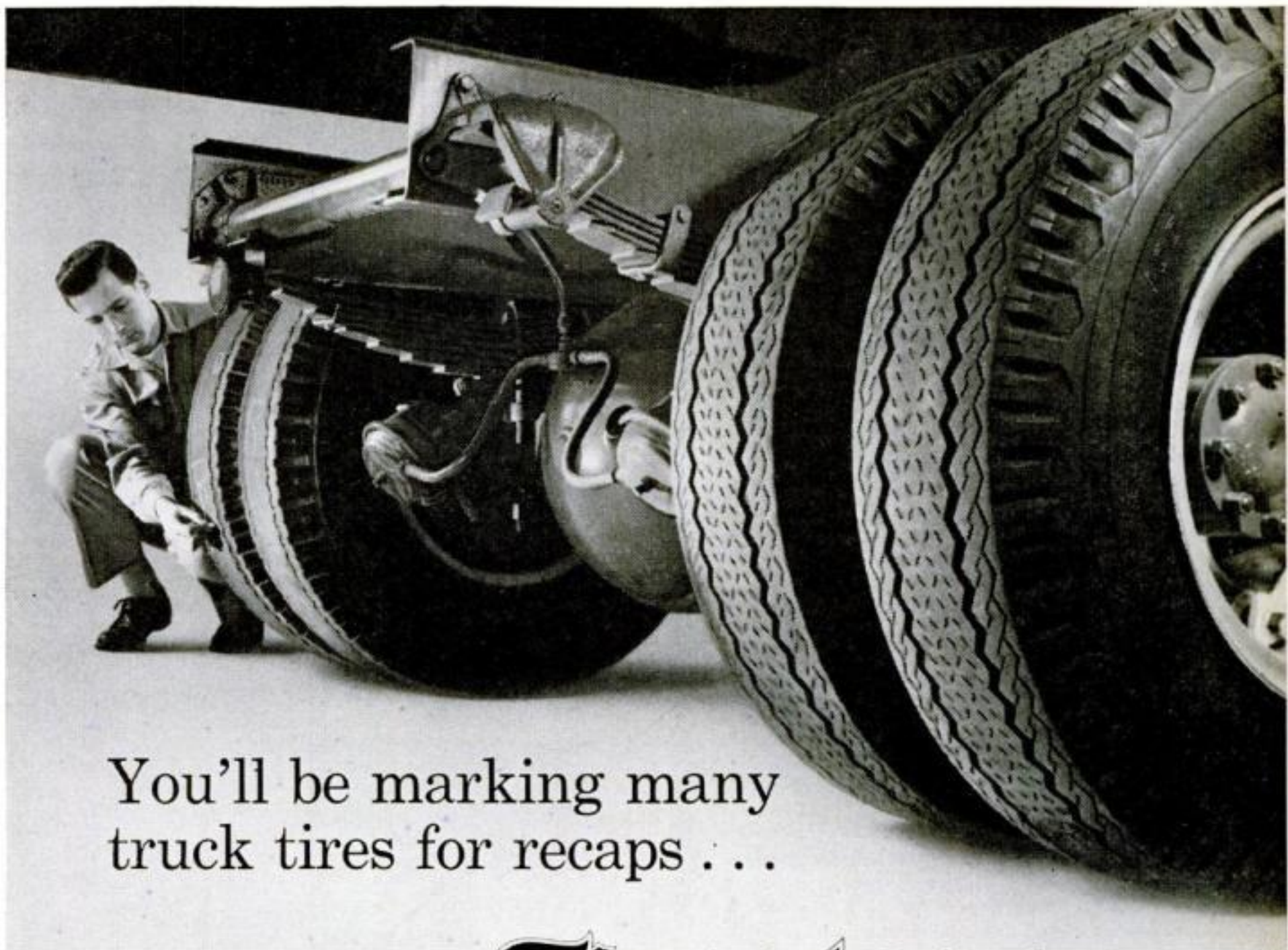
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Best mileage was posted by a stick-shift Rambler American. The happy guy stepping out in foreground is an American Motors' press agent.

## Rambler Is Champ in Economy Run

TODAY'S cars, according to some old-timers, are all gas hogs. Can't beat those old tin lizzies for economy, they say with a nostalgic gleam in their eye.

Don't you believe it. The recent Mobil Economy Run proved that cars today are far more efficient than in prewar days.

The Economy Run is an annual test of the ultimate gas-mileage potential of current-model cars. This year it stretched 2,500 miles from Los Angeles to Detroit. It included city streets and expressways, deserts and mountains—conditions a typical motorist encounters on a vacation trip. To make things tougher, a 42.39-m.p.h. average had to be maintained. This sometimes made gas-wasting speeds necessary to make up for lost time in traffic.

I drove along in a factory courtesy car, a Dodge Dart, and can vouch for the fact that driving for top economy is a tedious job. Strangely, our car fared slightly better than the official Dart entry—in spite of occasional bursts of speed of up to 80 m.p.h. Obviously the Run car, with veteran driver Art Rene at the wheel, was in less than perfect tune.

The 44 cars that finished this year averaged 22.7 m.p.g. In the first Run, back in 1936 when the route was a short 352 miles

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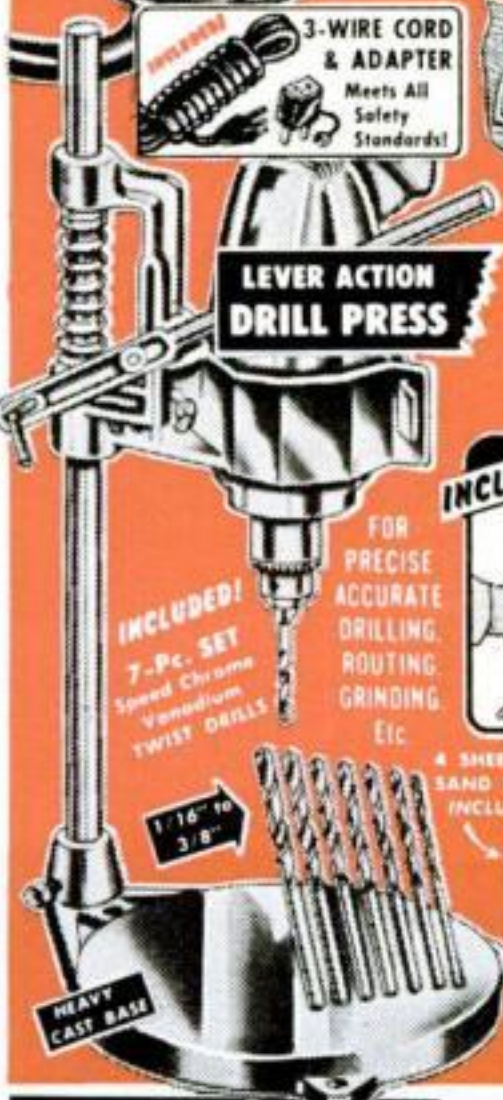
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## Rambler Is Champ in Economy Run

from Los Angeles to Yosemite, the entries averaged 22.5 m.p.g. They included such legendary names as Graham, Auburn, Terraplane, and Hupmobile. The 1962 cars, far more powerful, actually used less gas.

Amazingly, average gas consumption remained at around 21 or 22 m.p.g. in all the Runs from 1936-55. In 1956 and 1957, economy dropped slightly. Automatic transmissions (made mandatory in 1955 on all entries) had teamed up with horsepower and the trend toward bigger cars.

**Mileage goes up again.** Average engine size of the entries went from 326 cu. in. in 1960 to 255 in 1962. Average horsepower shrank in the same period from 243 to 173. The increasingly popular compacts had much to do with this. Stick shifts were allowed to compete again this year and last, though only in the compact class. Average car weight dropped drastically.

As in other years, cars were divided into classes according to size and type of engine, and price. This system has provoked criticism in the past. After the Run, class winners loudly advertise their victories, giving the public the impression that everyone wins the Run. Mobilgas officials argue that the Run can be likened to a prize fight and you can't—with fairness—pit a featherweight against a heavyweight.

**Your car and the figures.** If you expect your new car to do as well as the Run entry, you'll be disappointed. Competing drivers take extreme pains to squeeze out that last fraction of m.p.g.

But the figures do show relative economy. If car A beats car B in the Run, chances are A will give *you* better mileage, too.

Though entries must be absolutely stock, they're expertly broken in and tuned. Power accessories are used as little as possible. Windows are kept closed to reduce drag.

Jack-rabbit starts are taboo. High speed is avoided as much as possible since economy drops off rapidly above 50 m.p.h.

Keeping a steady foot on the accelerator is important. Some drivers actually have the soles of their shoes ground down for better pedal feel.

**Do drivers cheat?** Regulations are strict. All traffic laws must be obeyed. Refueling may be done only at specified check points, where special instruments measure gas to within a few drops. An observer rides in each car to enforce the rules. At each overnight stop, hoods and gas tanks are sealed



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## Rambler Is Champ in Economy Run

and the cars guarded to prevent tampering.

Chances of an undetected infraction are practically nil. When Bob McDaniel eased his Plymouth Savoy out to pass a truck, his observer didn't notice the no-passing sign. But an observer two cars behind did. McDaniel's penalty: two minutes of idling. This really hurt, since McDaniel ended up only .07 m.p.g. short of first place in his class.

One driver, who asked to remain anonymous, admitted that occasionally he has tried to engage the observer in conversation so a traffic-law violation would go unnoticed. He rarely got away with it.

Another driver admitted he sometimes momentarily noses in close behind a truck after passing another vehicle, to make use of the partial vacuum created by the truck.

A form of "legal cheating" many drivers indulge in is following as straight a line as possible through curves. Over the long haul this can cut several miles off the route.

—Alex Markovich.

## How They Ran in 1962

(Listed in order of standing—first three cars only)

COMPACTS, MANUAL SHIFT	DRIVER	M.P.G.
RAMBLER AMERICAN 400.....	Les Viland .....	31.11
FORD FALCON 144.....	Dan D. Jones .....	30.49
CHEVY II (four-cyl.).....	Bill Horton .....	30.04

### SMALL-ENGINE COMPACTS

CORVAIR MONZA.....	Pat Sawyer .....	27.02
FORD FALCON.....	Leon Funderburk .....	25.64
CHEVY II (four-cyl.).....	Mary Hauser .....	25.63

### LARGE-ENGINE COMPACTS

TEMPEST (four-cyl.).....	Mickey Thompson .....	27.30
RAMBLER AMERICAN 400.....	Tommy Thomas .....	27.09
VALIANT V-100.....	William McNulty .....	24.87

### LUXURY COMPACTS

VALIANT .....	Joe Sturm .....	24.85
DODGE LANCER.....	Danny Eames .....	24.40
BUICK SPECIAL V-8.....	John Rich .....	23.68

### STANDARD-SIZE SIXES

PLYMOUTH SAVOY.....	Robert Cahill .....	24.61
DODGE DART.....	Woody Bell .....	22.84
CHEVROLET BISCAINE.....	Paula Murphy .....	21.62

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CHEVROLET IMPALA.....	Byron Froelich .....	20.78
FORD GALAXIE.....	Bill Levy .....	20.75
PLYMOUTH SAVOY.....	Bob McDaniel .....	20.71

### MEDIUM-PRICED CARS

PONTIAC STAR CHIEF.....	Judy Thompson .....	19.48
OLDS DYNAMIC 88.....	Stan Raymond .....	19.05
CHRYSLER NEWPORT.....	Mel Alsbury Jr. ....	18.96

### HIGH-PRICED CARS

CHRYSLER NEW YORKER.....	George Alsbury .....	18.11
OLDSMOBILE 98.....	Link Paola .....	17.52
BUICK ELECTRA.....	Barney Navarro .....	17.25





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# The march of SCIENCE

By Martin Mann

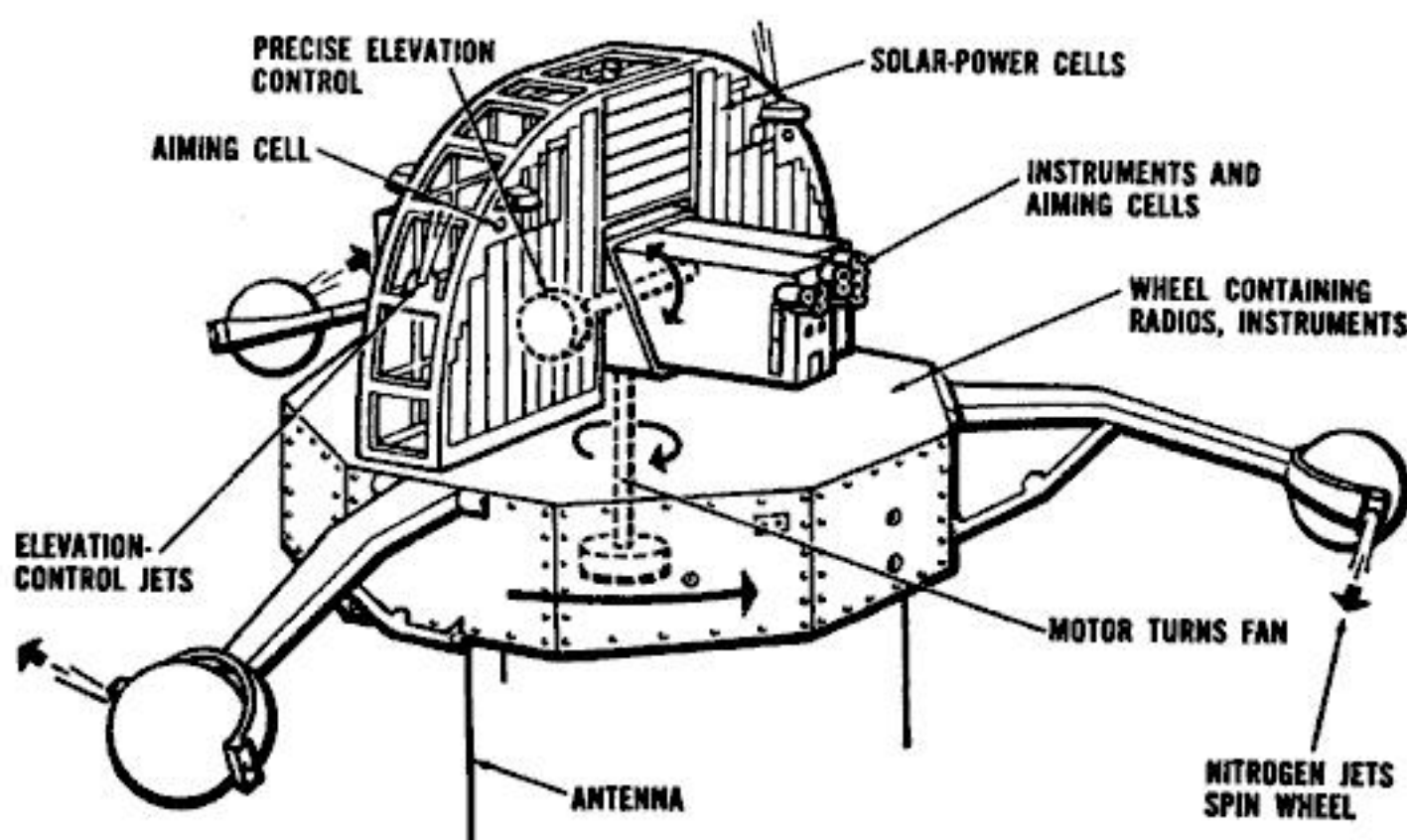
## Now—spare parts for your body

In the slow and painful progress toward saving human lives by transplanting body organs, another hesitant step forward has been taken. Three persons now live on other people's kidneys.

Ordinarily your body rejects tissues that it did not manufacture itself. This protects you against disease. Only identical twins have the same protective systems and can trade tissues with each other. The new successes are transplants between people who were not identical twins, although they were close relatives. One man uses a kidney donated by his mother. These transplants took because the patients' protective systems were temporarily knocked out by heavy doses of radiation. (For another approach, see p. 74.)

## New model year for satellites

Down at the Cape they call it the first of the second-generation satellites; in Detroit they would call it all-new-from-the-wheels-up. In any jargon, OSO—orbiting solar observatory—is a dilly, a marvelously intricate piece of scientific machinery that is performing like a Ferrari at LeMans.



OSO is designed to measure radiation from the sun, which could injure astronauts. It hit an almost perfect orbit—aimed to circle at 350 miles out, it ended up ranging between 340 and 370 miles. And it is pointing at the center of the sun with an accuracy equivalent to hitting a penny from half a mile away (that's twice as good as had been hoped).

This precision comes from ingenious design. OSO is a fan mounted on the axle of a wheel. The wheel is kept spinning

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## The March of Science . . . continued

(30 r.p.m.) by jets of nitrogen gas, which intermittently hiss out from bottles on three outriggers. This makes the whole satellite a gyroscope, and it holds its position as a gyroscope does. The fan, covered with instruments and 1,860 solar-powered cells, has to face the sun. So it's spun by a motor in the axle, turning opposite to the wheel just fast enough to "stand still." That takes care of azimuth. But the satellite will tip a little—the precession of a gyroscope. To counter that, there's another set of nitrogen jets on top of the fan. For final precise aiming, the separate instruments are swiveled electrically. All these movements are controlled by photocells that look at the sun and signal the jets and motors to go fast or slow, start or stop.

OSO is one of 11 satellites being sent up to monitor the sun during a "quiet period" of solar activity (from above the atmosphere they can record rays that never get through the air to ground instruments). It was expected to operate six months—once the supply of nitrogen runs out, it cannot hold its aim. However, it has proved to be so stable, needing so few correcting blasts from the jets, that it will probably work longer.

## New piece of atomic jigsaw puzzle

With a modest flourish of whoop-de-do and an astounding display of international politeness, 40 physicists from five different European and American laboratories announced that they have found another elementary building block of the atom. This one is anti- $\Xi$ -minus (the Greek letter is pronounced ksi). It was discovered simultaneously with the huge atom smashers at Cern, in Switzerland, and Brookhaven, near New York. ("Simultaneously" means that the two groups, each knowing the other was hot on the trail of anti- $\Xi$ -minus, agreed in advance to avoid a catfight over priority.)

Anti- $\Xi$ -minus cleans things up a bit because it is the mirror-image "antipar-





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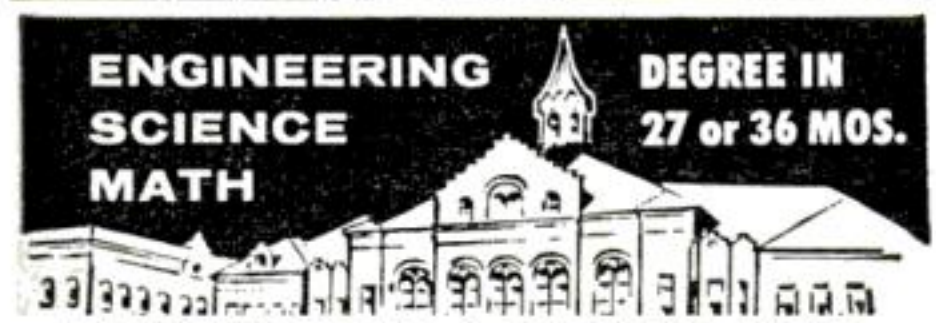
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## The March of Science . . . continued

ticle" of another piece of the atom,  $\Xi$ -minus, confirming the idea that all atomic particles have antiparticle brothers. It also supports the theory that predicts a total of about 30 pieces. Anti- $\Xi$ -minus is No. 29.

How all these pieces fit together to make a picture of the atom is something else again. Nobody knows. Of the 30 pieces, only three (electron, proton, and neutron) are ordinary parts of all things in our universe. The others pop up when you crack atoms open, and they disappear almost immediately. Anti- $\Xi$ -minus has a life of one-tenth of a billionth of a second. It appears when an antiproton smashes hard into a proton. That is, it appears once in a great while: The Brookhaven group scanned 34,000 photographs to find one, and the Cern researchers pored over 85,000 pictures to find theirs.

The hunt is now on for the last missing piece of the atom, anti- $\Xi$ -zero. When it is found, nobody will know exactly what to do with it. This fantastic effort—involving atom smashers that cost \$100,000,000-up and most of the world's brightest scientific brains—has absolutely no practical purpose. It won't cure cancer or generate cheap electricity. But maybe, just maybe, it will tell man something he has always wanted to know: What is the world made of?

## Making dope squeal on its grower

New tests for narcotics are so sharp that they even reveal the place where the stuff was grown, scientists from the Canadian Food and Drug Directorate reported to the American Chemical Society this spring. Opium can be traced by measuring its concentration of PM (porphyrroxine-meconidine), which varies with the country of origin. Marijuana gives its source away with the resins it contains—the resin composition depends on hours of sunshine, amount of rainfall, kind of soil, and latitude. A good chemist who knows his geography



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## The March of Science . . . continued

can tell the enforcement agents where to look for the smugglers.

## The not-so-speedy hummingbird

Another of those myths about the fabulous speeds of animals has been shot full of holes. This time it's the hummingbird. It can hit 60 m.p.h., as claimed, says Dr. Oliver P. Pearson of the University of California, but only in the power dive the male puts on to woo a mate. In straight and level flight, the hummingbird ranges between 18 and 24 m.p.h. Other small birds fly as fast: The song sparrow makes 16 m.p.h., the white-crowned sparrow 20, and the brown towhee 22. Dr. Pearson checked by releasing birds in a highway culvert and taking movies as they flew out.

## Plenty of water in space

We may be running out of usable water down here on earth, but apparently that problem need not bother astronauts. Using a new process developed by Dr. Frank J. Hendel of North American Aviation, a spaceship might get to its distant destination carrying more water than it started out with. Each astronaut needs about seven pounds of water per day. Dr. Hendel figures to get that all back—plus an extra pound—by mixing wastes into a sludge and burning the sludge at 850 degrees F. with an electric heater. At that temperature, all the water is evaporated and all the organic solids are broken down to water, carbon dioxide, and nitrogen. The water vapor would be condensed into pure liquid, ready for use again. The excess, Dr. Hendel suggests, might even be allowed to evaporate into space to cool the cabin.

## How often do you swallow?

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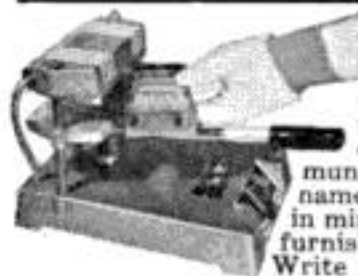
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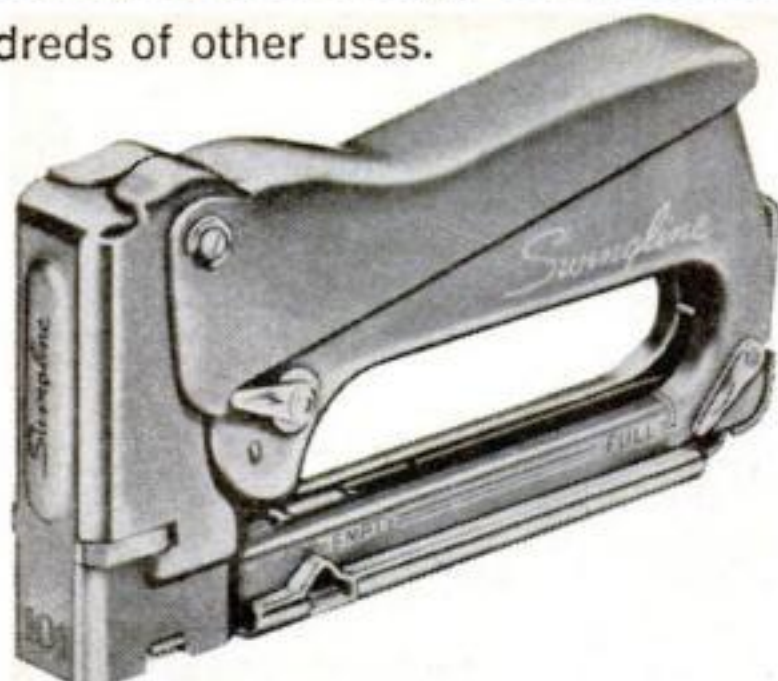
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## The March of Science . . . continued

ing gadgets around the necks of 15 volunteers, found that the average number of swallows is:

Sleeping: 7.6 per hour

Reclining, awake: 31 per hour

Reading: 34 per hour

Eating: 4.8 per minute

Dr. Lear's curiosity does have a practical purpose: Swallowing may affect the amount of saliva, which in turn affects bacteria in the mouth.

## Sunglasses adjust to the sun

Sunglass lenses that get darker when the light gets brighter and fade when the light dims are suggested by the research of John F. Dreyer of Polacoat, Inc. (Blue Ash, Ohio). Dreyer found several dyes (Crystal Violet is one of the best) that darken in the light and bleach in the dark. The change occurs very quickly—10 to 30 seconds. The dye can be incorporated into plastic lenses. The drawback is a gradual weakening of the effect from repeated light-dark reversals. Dreyer's work was sponsored by the Air Force, which isn't overly worried about ordinary sunglasses but needs goggles that will instantly darken at the flash of an H-bomb and protect pilots' eyes.

## City folks sick, sick, sick?

Four out of five people studied in midtown New York City suffer from some kind of mental trouble, and one in five is markedly sick. That's what a new book by a group of psychiatrists says (*Mental Health in the Metropolis*, McGraw-Hill, \$9.95). Striking differences turn up: The poor are troubled more than the rich are. Married men and married women suffer equally, but bachelors are worse off than single women, and divorced people of both sexes are the most seriously afflicted of all. The big town's mental disturbances do not disturb the experts. They conclude, as the rest of us have suspected all along: Nearly everybody is a little bit strange, and it's normal to be abnormal. ■ ■



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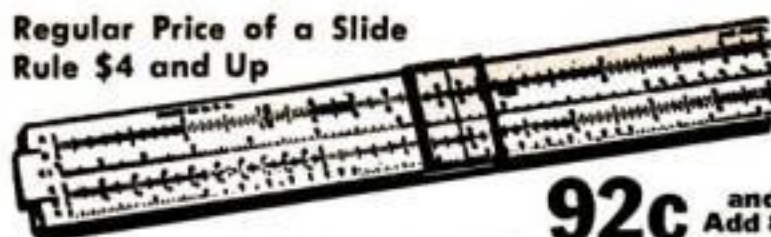
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**1937** "Seeds subjected to sound waves that are inaudible to the human ear grow faster than untreated seeds, according to experiments being made by Prof. S. N. Rzhevkin, Russian scientist. A pea seed exposed for three minutes to extremely high-frequency vibrations far outstripped a similar seed planted under normal conditions at the same time."

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# Detroit report

## What killed the Cardinal?

Last April the Ford executives in Detroit were as nervous as a cat on a hot tin roof. In the fall their company was to introduce a compact-compact. It bore the working name of the Cardinal. The subject of speculation for two years, the Cardinal would be slightly bigger than a Volkswagen. It would sell for only \$100 more. It would be unique. It would have the first U. S. front-wheel drive in almost a quarter of a century. It would go 35 miles on a gallon. And it represented a multimillion-dollar gamble.

At 7:30 p.m. Tuesday, April 10, a representative of Ford Motor, in Dearborn, Mich., urgently telephoned POPULAR SCIENCE automobile editor Devon Francis at his New York home.

"Here's an announcement," he said. "Ford isn't going to sell the Cardinal in the United States."

He read off a statement by Henry Ford II, board chairman. The decision, said the statement, had come "after long and serious consideration and as a result of market conditions and other factors."

POPULAR SCIENCE had a two-page article in its May issue titled, "What Ford's New Little Car Will Be Like." Days before, the presses had begun whirring on the issue. Some 600,000 copies had already been printed.

The presses were stopped. A short announcement of Ford's decision was inserted. The headline was changed to: "What Ford's New Little Car Would Have Been Like." Nothing could be done about the magazine cover, already printed, which bore a line about the story inside.

### "Something Had Happened . . ."

Six weeks before, Ford had officially said that it was, indeed, going to market

a midget car in the U.S., assembled at its Louisville plant. Something had happened in the meantime.

What killed the Cardinal, first and foremost, was you, the auto-buying public. Your tastes totted up to hard facts in simple arithmetic.

In 1959, the peak year for imported automobiles—almost all of them small ones of the compact-compact size—you bought 614,131 of them. (A quarter of them were Volkswagens.) In 1960 the import figure had slumped to 498,785. You, the motorist, were going strong for U.S.-made compacts at the expense of the imports. Moreover, you had begun to rediscover the pleasures of owning standard-size cars. You were buying more of them.

Now we come to 1961. Again, you bought a lot fewer imports—only 378,622. Even more of the bigger, standard U.S. cars were sold. And again—of that little German beetle, the VW, you bought 203,863, or 53 percent of all the imports.

Although total sales had dropped way off, the toughest competitor in the field had become alarmingly muscular.

"If we had brought out the Cardinal," remarked Lee Iacocca, head of the Ford Division, a few days after his boss's announcement, "our timing couldn't have been lousier."

You liked the VW. It was firmly entrenched in your heart. Your ardor for the other little foreign cars had cooled. Again the arithmetic: If you kept buying more VWs, there'd be pretty slim pickings left for the Cardinal. Perhaps worse, if you liked the Cardinal, your purchases might be at the expense of Ford's booming compact, the Falcon. That wasn't good business for Ford.

### The Edsel Looked Good, Too

Ford still blushed to the ears when it remembered the debacle of its Edsel. The Edsel looked good on the drawing board. In the salesroom you, the motorist, then on an economy kick, thought it looked like just another big car, with too many spangles. That killed the Edsel. The Ford Motor Co. wanted no repeat



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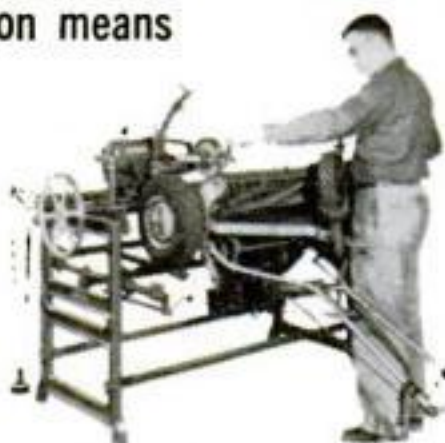
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## DETROIT REPORT . . . continued

of that \$250,000,000 bad decision.

Indeed, as Henry Ford II said, there were "other factors." Item: As Detroit moves into the summer months, you are buying a spectacular number of the bigger cars. The Chrysler Corp. is joyful at the sale of big Chrysler Newports.

Item: You are demanding glossier models. Ford Motor alone is four months behind on orders for Galaxies with bucket seats and four-speed manual transmissions. That doesn't look as though you were cottoning to a tiny, austere, economy car like the Cardinal.

The Cardinal isn't dead. It's only dead here. It will be manufactured for sale in scores of other countries. No doubt you will still be able to buy one—if you want one—as an import.

## Hotter spark plugs

Back in 1959 we printed an article about the coming revolution in auto ignition systems—with transistors. It's almost here as a factory-installed option. Only in trucks, though. For a price, Ford will equip its 1963 trucks with transistor ignition. This is what truckers will get for the extra money: longer plug life, easier starting, better gas mileage, no spark skips at high speed, and a hotter spark. Installation in cars, at first as an option, later as standard equipment, is only a matter of time. Motorola, in fact, already is offering such a system through its dealers.

## Grease monkey, begone!

As anyone who has argued the quality of workmanship with a service station in recent years is well aware, there's a shortage of good mechanics. Today's mechanics can take off an old part and put on a new one, but as for repair—pshaw! Now American Motors has issued a call to car manufacturers, dealers, and the nation's schools to sponsor a program to encourage top-flight students to become auto mechanics. "The day of the back-alley 'grease monkey' is long gone," says an official of the company.



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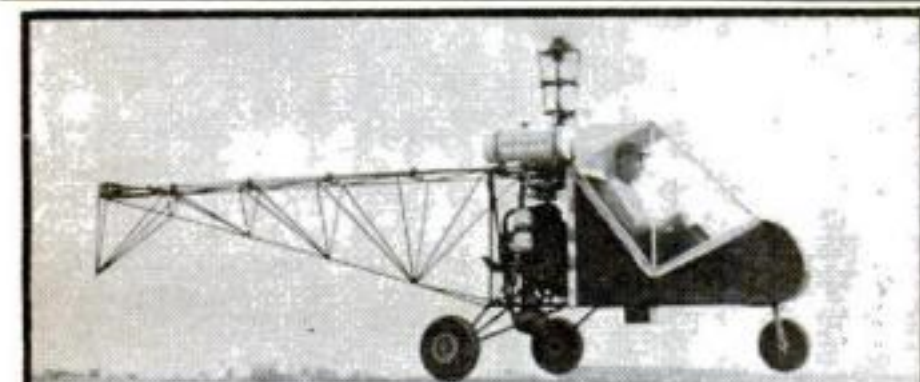
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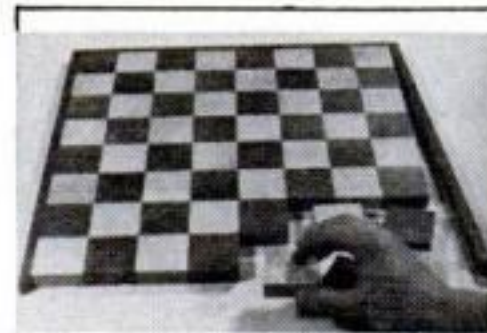
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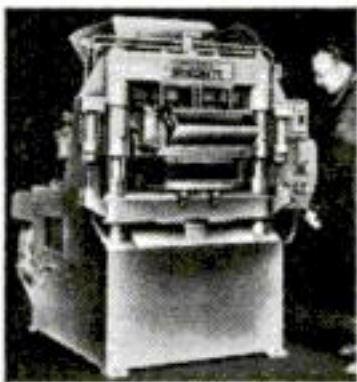
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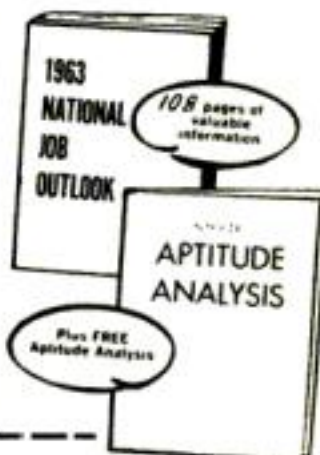
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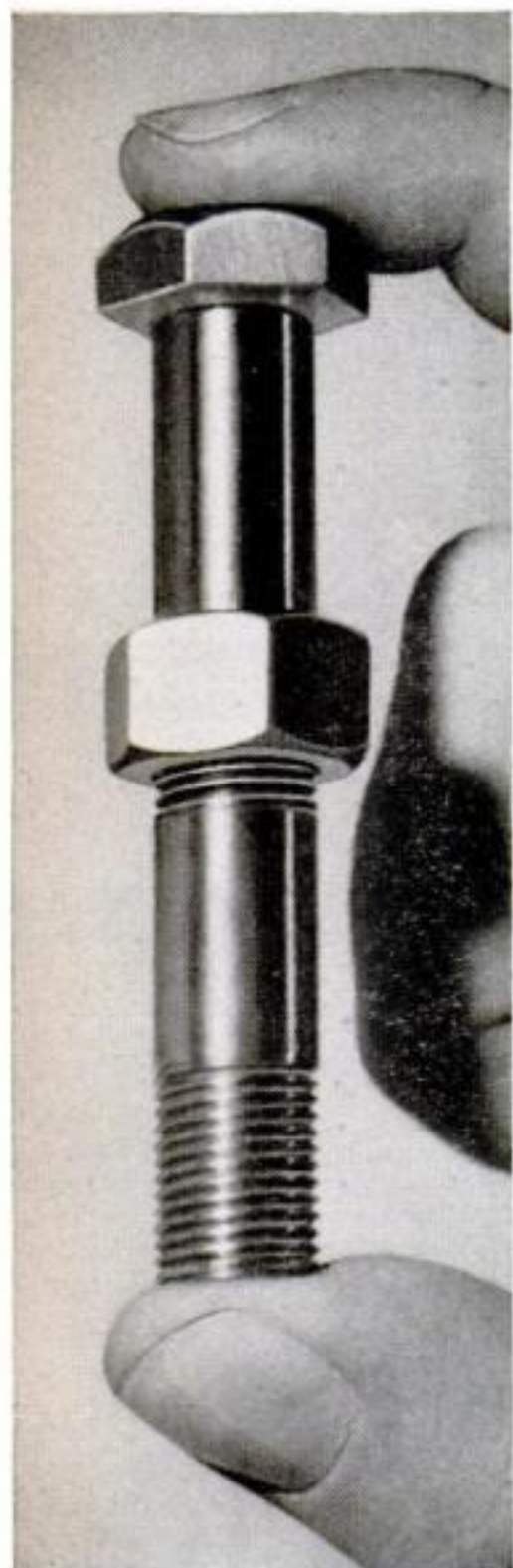


# Home Shop NEWS REPORT

by Sheldon M. Gallager

## Nut-and-bolt mystery—can you solve it?

Look what turned up in our mail. The impossible-seeming bolt in the photo has a nut threaded on it smack in the middle—where no nut should be. The nut turns freely, making two and a half revolutions from one end of the threaded section to the other. The author of the puzzler assures us that the nut is stock and was altered in no way. The bolt, shown actual size, was turned on a lathe and has a constant  $\frac{1}{2}$ " diameter. The threads are standard  $\frac{1}{2}$ "-20 NF. Close examination reveals no joint in either the bolt or nut. Can you guess the answer? The author admits it's a trick and promises a solution in time for next month's PS.



## Looking for projects? Here's a bumper crop

The Rez people, who make wood finishes, have come up with one of the niftiest home-shop guides we've seen in a long time. It's a 90-page booklet packed with more than 70 working plans for built-ins, room dividers, play-room bars, outdoor furniture, fences, and many other projects. Also included are facts about woodworking and step-by-step instructions for creating a score of handsome finishes. You can get a copy, called "Beautiful Wood Creations for Your Home," for \$1 from Rez Wood-Tones, Inc., P.O. Box 142, Springdale, Pa.

## It's true: Left-hand drills really do exist

Ever since we showed a radial-arm saw set up for drilling, readers have been asking how come, since everybody knows that radial saws turn to the left and drill bits turn to the right. Two answers: Many newer machines provide a right-hand spindle for just this purpose. But for southpaw machines there's still an easy out. Both Delta and DeWalt provide left-hand wood bits, available from local dealers. (It took me years to learn there's really a left-hand monkey wrench, too.)

## The weird and wonderful world of liquid lock washers

Got to talking with some of our contributor friends about Loc-tite, an adhesive-like product that's sold as a "liquid lock washer." Put a dab on a bolt and it takes a wrench to get the nut off. Ought to be good uses for stuff like this, we figured, so we asked our friends to pass along their favorites:

*Phil McCafferty:* "A dab on my car's tire valve keeps prank-





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with new "Dutch Boy" Latex House Paint**

Now there's a new kind of paint that ends all the old problems of conventional colored paints. It's "Dutch Boy" Latex House Paint. Use it and your house will stay looking bright and fresh for years. Made with "Dutch Boy's" own acrylic resins, tests have shown it to be outstandingly resistant to sunlight and oxidization. In fact, this new paint retains its color so well you can come back and touch it up years afterwards, and not see the difference. When it's time for a new paint job, you'll only have to repaint the weathered side. Keep the same color and you may never have to paint your whole house at one time again!

"Dutch Boy" Latex House Paint is probably the most convenient paint ever developed for the weekend painter. You don't have to wait for ideal weather. Use it right after a rainstorm if you like. And you can stop and start anywhere. Lap marks won't show.

It's easier to use, too. "Dutch Boy" Latex House Paint flows off the brush, without paint drag. And this one paint is all you need for almost any surface—wood, stucco, brick and even composition shingles.

More advantages: Brushes and equipment clean up with just soap and water. And you can eliminate most of the blistering and peeling problems that used to be caused by trapped interior moisture. "Dutch Boy" Latex House Paint breathes—allowing moisture to escape, yet sealing out the weather.

If you'd like to find out more about this remarkable paint, check with your nearest "Dutch Boy" dealer, listed in the Yellow Pages. Or write for informative free booklet to: NATIONAL LEAD COMPANY, General Offices, 111 Broadway, New York 6, N. Y.

**Dutch Boy**  
LATEX HOUSE PAINT®

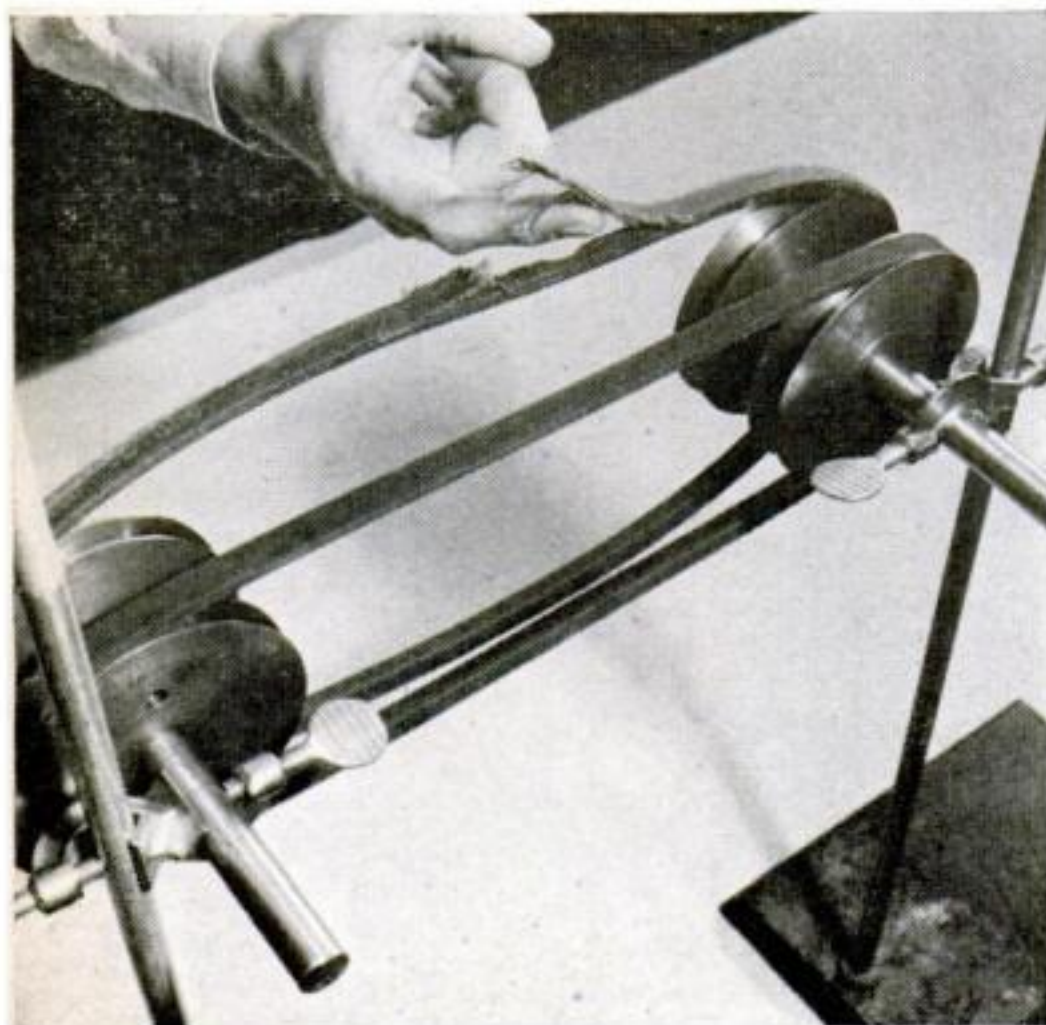


sters from letting the air out. It's great for shimming bearings, will even join copper tubing without solder." *Jackson Hand*: "I use it to lock camera lenses in their mounting flanges so they can't untwist when I change settings." *George Daniels*: "It tightens up cupboard-door hinges so the doors still work but don't keep swinging out in your face. And here's an oddball—it makes gear-turned musical instruments, such as guitars, really stay in tune. While normal curing time takes several hours, we found it can be speeded up to a few minutes by holding a 75-watt light bulb a few inches away." *Walter E. Burton*: "It solves many lathe problems by letting you assemble parts, without threading or soldering, into complicated shapes that would be difficult to machine in one piece." *John Burroughs*: "It's the stuff to use to lock, leakproof, and rustproof steel bolts used in boat-building." *Harry Walton*: "Need a quick metal bearing for a wood part? Wind brass or copper wire around a shaft, cement the coil with Loctite, then drive it to a snug fit in the hole. The stuff is fine, too, for sealing wear-enlarged carburetor openings that let in air around the choke and throttle shafts."

And we bet you'll find many other uses on your own. Loctite is made by American Sealants Co., Hartford, Conn., and is sold in hardware stores in small plastic tubes and bottles.

## Coming soon: "glass" V belts for longer life

Keep an eye out for a new kind of V belt that sounds exciting. It has a core of high-strength glass cord, said to increase belt life up to four times and eliminate the problem of stretch. In the photo below, a conventional V belt is shown frayed and fraz-



zled after 400 hours of torture tests, while one of the new glass belts beside it remains unruffled after 600 hours. The belts, developed by B. F. Goodrich, will be available only to manufacturers at first, but will go into full production later this year.

## Door closers for cupboards

They've taken those fancy pneumatic closers you've seen on big doors and made a baby version for cupboards. Only 10" long, it automatically whisks a door closed as you let go and holds it shut without a latch. It sells for 65 cents from Ideal Brass Works, 219 East 9th St., St. Paul, Minn.





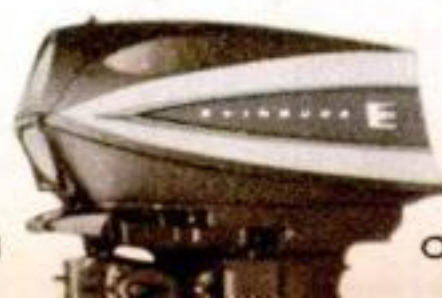
# WELCOME TO EVINRUDE COUNTRY

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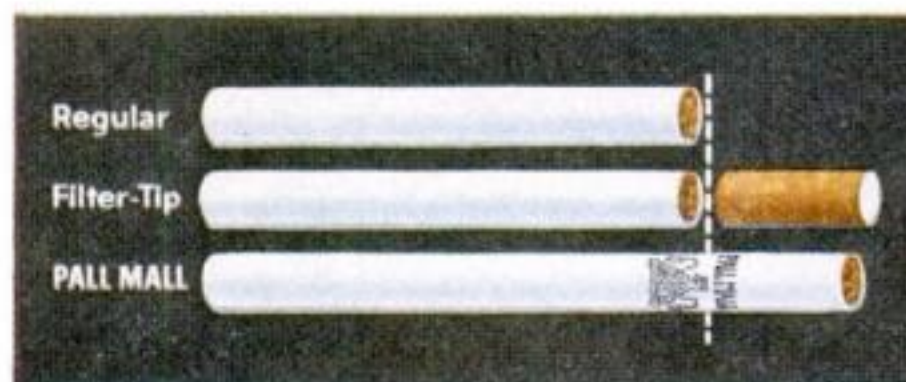
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# How to Get Down from 100 Miles Up



Here's the way a U.S. astronaut slows to a stop from 17,500 miles an hour, to land safely after orbiting through space

By Wesley S. Griswold

**W**HEN a U. S. astronaut returns from orbit, he must slow down from 17,500 miles an hour to about 20.

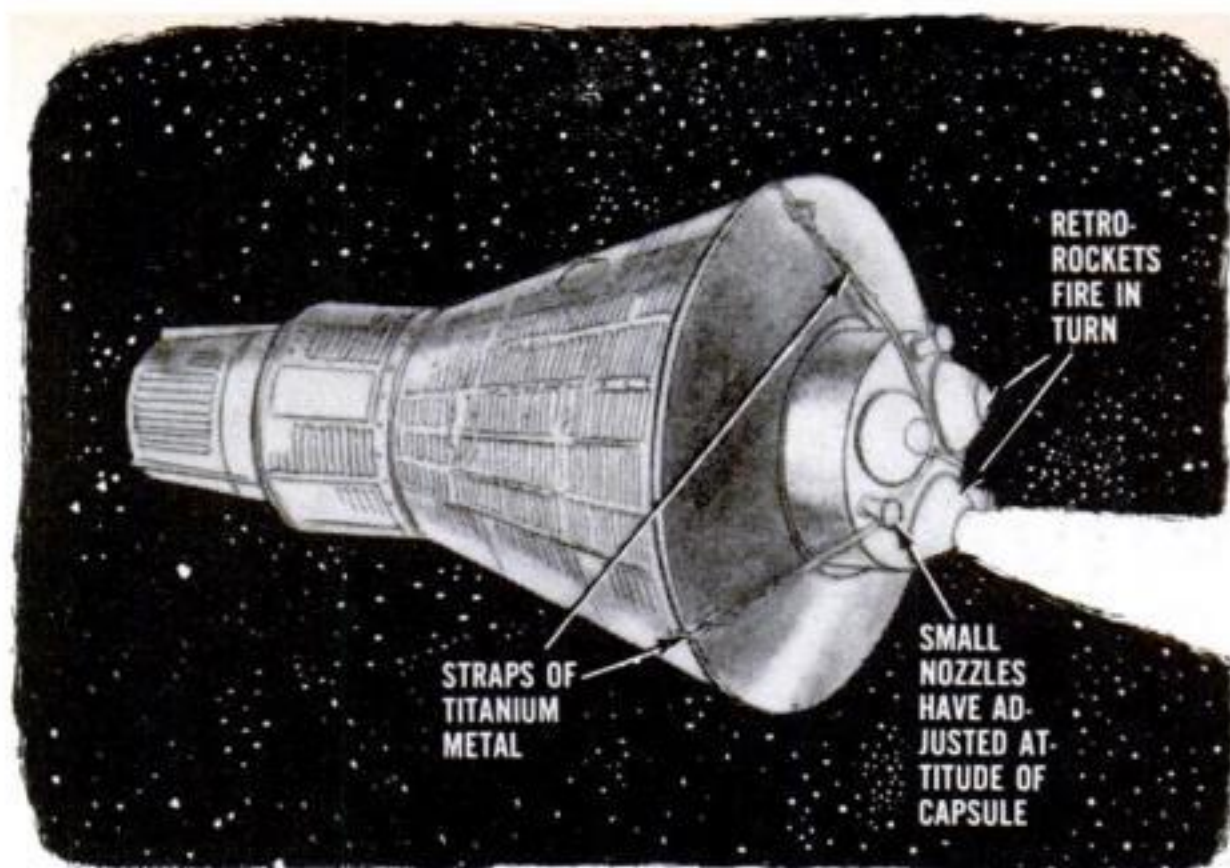
While doing this, his spacecraft plunges forward a few thousand miles

CONTINUED

45



A kick from backward-firing rockets begins an elaborate series of maneuvers that ends when a manned capsule splashes gently into the sea



Three retrorockets, fired one at a time, reduce speed of capsule to divert it from orbit and start it on its way down.



and downward around 100 miles. It all takes an astonishingly short time—in Lt. Col. John Glenn's case, 23 minutes.

How does anybody make this most spectacular of human falls and come out alive and unharmed? The accompanying drawings show the sequence of actions that makes the awesome descent practical and safe.

The astronaut's homeward dive begins when he fires three retrorockets attached to the base of his little black spacecraft. Timing is of the utmost importance. He's traveling five miles per second. An error of one second in firing the retros will land him five miles off target.

As he zooms toward California on his final swing across the Pacific, he makes a time check with Point Arguello, Calif. He then sets a timer to trigger the retrorockets, and braces himself for a hair-raising deceleration.

(If he should be disabled or unconscious, Point Arguello can and will fire

the retrorockets by radio command.)

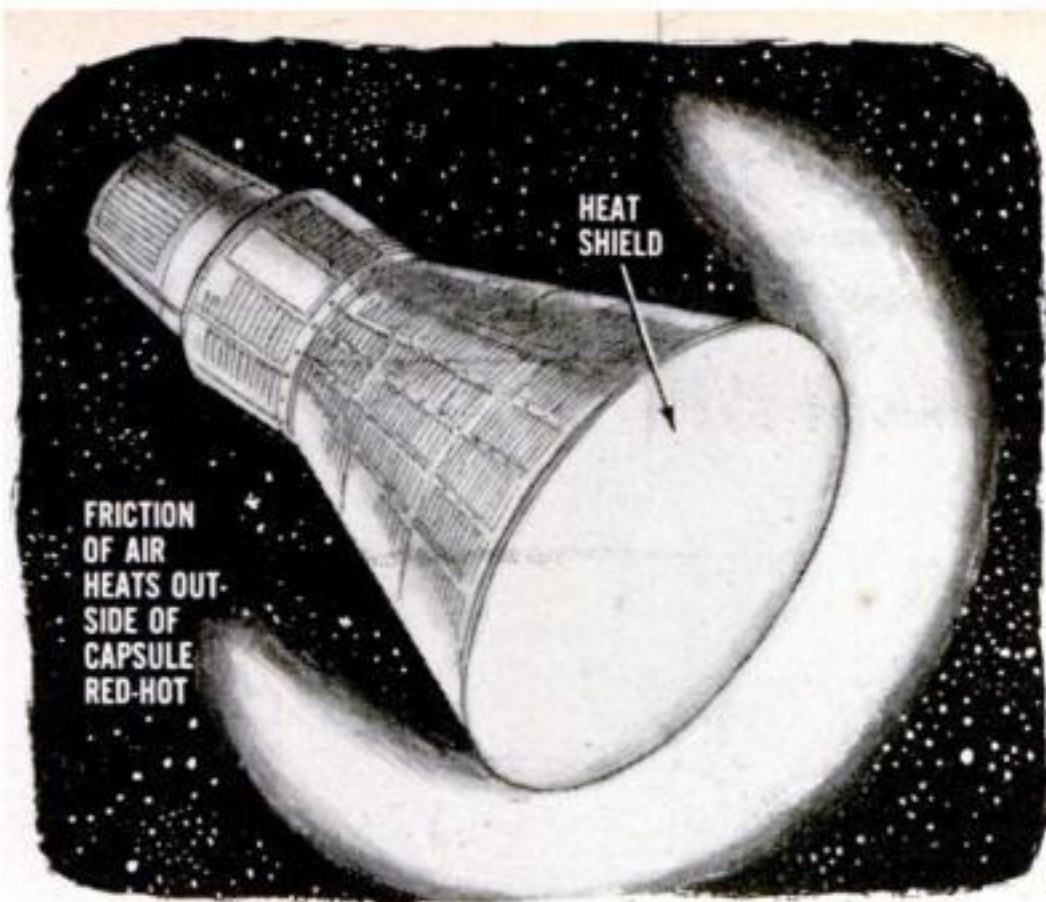
Remember, as this crucial instant nears, that the 12-foot, bell-shaped spacecraft is hurtling along with its six-foot-wide bottom foremost. Its occupant is riding backward, facing the craft's 28-inch neck. Packed inside one half of that neck lies the eventual means of saving his own.

**The retrorockets fire in sequence:** at five-second intervals. Their effect is that of applying enormously powerful brakes.

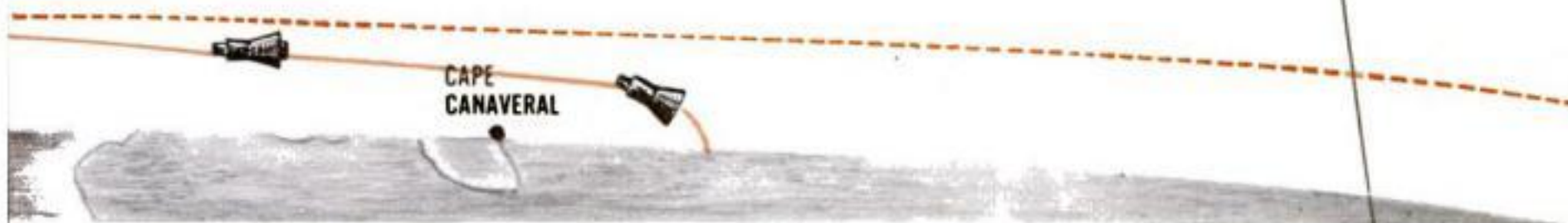
When this happened to Col. Glenn's "Friendship 7" as it rushed toward California from out of the west, he exclaimed into his mike, "It feels like I'm going clear back to Hawaii."

The dramatically slowed spacecraft now starts descending in a long, flat, continent-spanning arc that ends with a splash in the Atlantic Ocean, off the Bahamas. Normally the retrorockets, in a package attached to the capsule by titanium straps, are dropped off as soon as they have been fired.





**2** As capsule hits earth's air, its outside briefly glows red-hot. Heat shield protects the astronaut within.



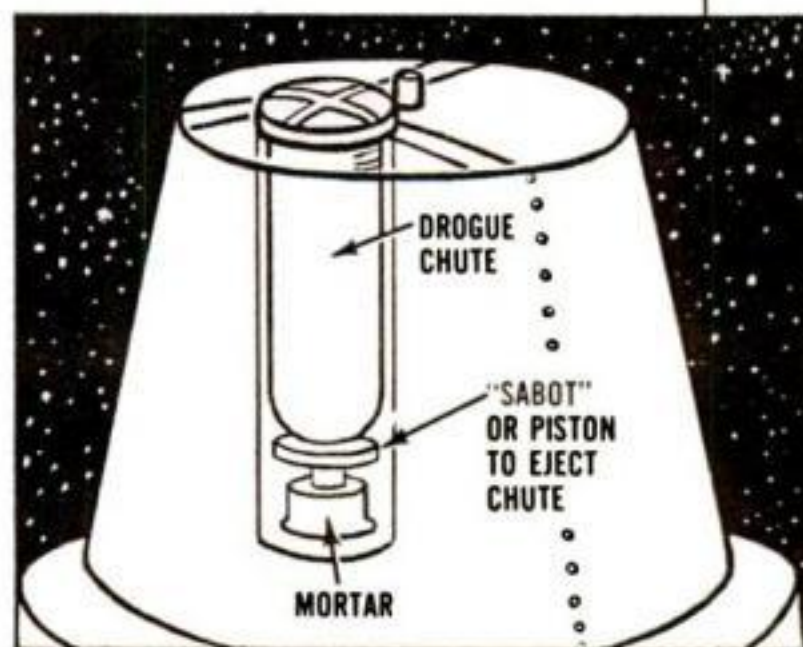
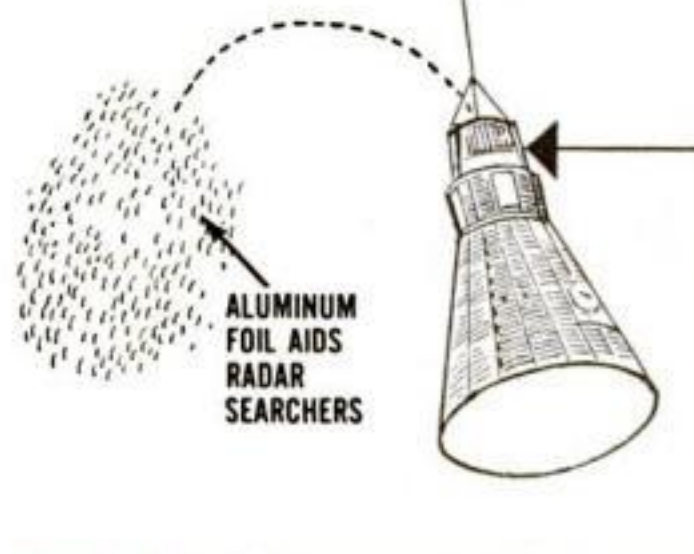
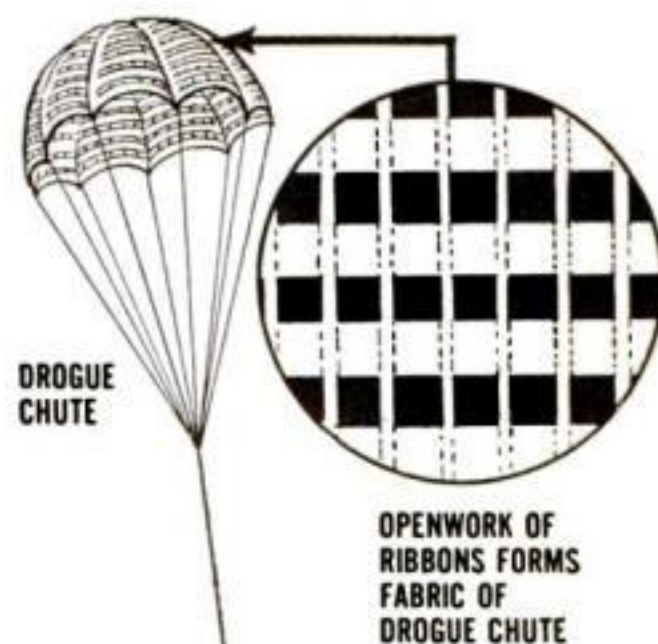
The fact that the craft is falling blunt-end forward makes it an aerodynamically rough object, and in itself helps to slow the descent.

Meanwhile, as it plunges deeper through the ever-denser layers of earth's atmosphere, the friction of its passage threatens to consume it.

The fiber-glass-lined heat shield, a false bottom, turns cherry-red as its temperature rises to 3,000 degrees. Its outer coating peels and burns away.

The spacecraft's own bottom, despite its protective shield, heats to 350-400 degrees. The air inside the craft warms noticeably—in Glenn's case, to 108 degrees. The astronaut himself, however, remains comfortable in his air-conditioned spacesuit.

**Braking.** By the time the craft has fallen from an altitude of more than 500,000 feet to 21,000 feet, it has slowed from its fantastic orbital speed to around 300 m.p.h. The instant it reaches 21,000 feet, a remarkable landing system, de-



**3** At 21,000-foot altitude, a mortar ejects small drogue chute (to slow capsule and steady it) and cloud of aluminum foil (to aid tracking the astronaut by radio).

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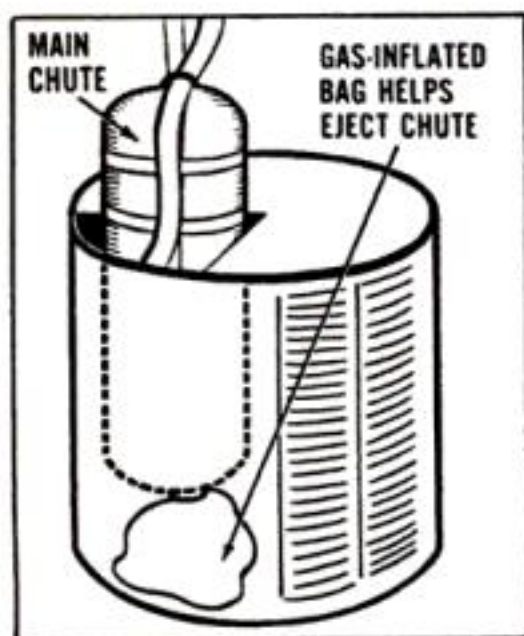




MAIN CHUTE (REEFED)



DROGUE CHUTE DETACHED



MAIN CHUTE

GAS-INFLATED BAG HELPS EJECT CHUTE

**4** At 10,000 feet, main chute is yanked out by drogue, which falls away. Depth charge drops to sea to signal where capsule will descend.



DEPTH CHARGE FALLS TO SEA



MAIN CHUTE (UNFURLED)

**5** Four seconds later, cutters slash reefing lines, and main chute fully unfurls.

veloped and built by Northrop's Ventura Division, goes into action.

At that altitude, a sensitive aneroid switch triggers a tiny mortar. A charge fires a small white drogue parachute out the top of the spacecraft. It's a ribbon chute. It looks like a bunch of rectangular holes stitched together. If it weren't full of holes, it would be as useless as an umbrella in a hurricane.

The drogue is on a 30-foot tether that places it out of the turbulent wake of the plunging spacecraft. It's only a six-foot parachute at best. The fierce tug on the lines puckers its mouth to four-foot width.

This seems a puny deterrent to speed and gravity, but it steadies the craft and slows it to about 185 m.p.h.

At the moment the drogue chute is flung out, a four-ounce package of shredded aluminum foil is tossed into the air with it. This bursts open and forms a target that looks as big as an airplane to search radars. Now they know about where the spacecraft will come down.

**Releasing the main chute.** At 10,000 feet, the antenna cover, which crowns the neck of the craft like the cap on a bottle, is automatically released. The drogue chute is anchored to the cover, which, in turn, is attached to the big main parachute. Drogue and antenna cover, together, yank out the main chute. Then they disconnect themselves and fall away.

The main chute, a 63-foot-diameter orange-and-white-striped job, streams out of its packing in reefed condition. It might be torn to pieces if unfurled too soon. For four precisely timed seconds, its mouth is not allowed to open more than 10 feet.

Then cutters attached to opposite sides of the big chute automatically knife through the reefing lines. The parachute's mouth widens abruptly to a 42-foot opening.

"The prettiest ol' sight you ever saw in your life," Col. Glenn called it.

This great nylon wind catcher hauls back on the spacecraft until it is drop-



ping toward the sea at a gent'e 30 feet a second, or 20½ m.p.h.

(If the drogue should fail to open, a red light would warn the astronaut. He then could release the main chute. In the unlikely event that it, too, should fail, he has an identical reserve chute to rely on.)

**Catching the Navy's ears.** As the main chute is pulled out at 10,000 feet, a 3½-pound depth charge, hardly bigger than a man's fist and wrist, plummets from the spacecraft to the ocean. It plunges 4,000 feet below the surface, and there explodes. Listening sonars on Navy vessels near and far hear the sound and promptly fix its location.

At 8,000 feet above the ocean, the spacecraft's heat shield drops four feet, pulling down a circular, silicone-coated, glass curtain, nearly its own size—a curtain with diagonal rows of two-inch holes in it.

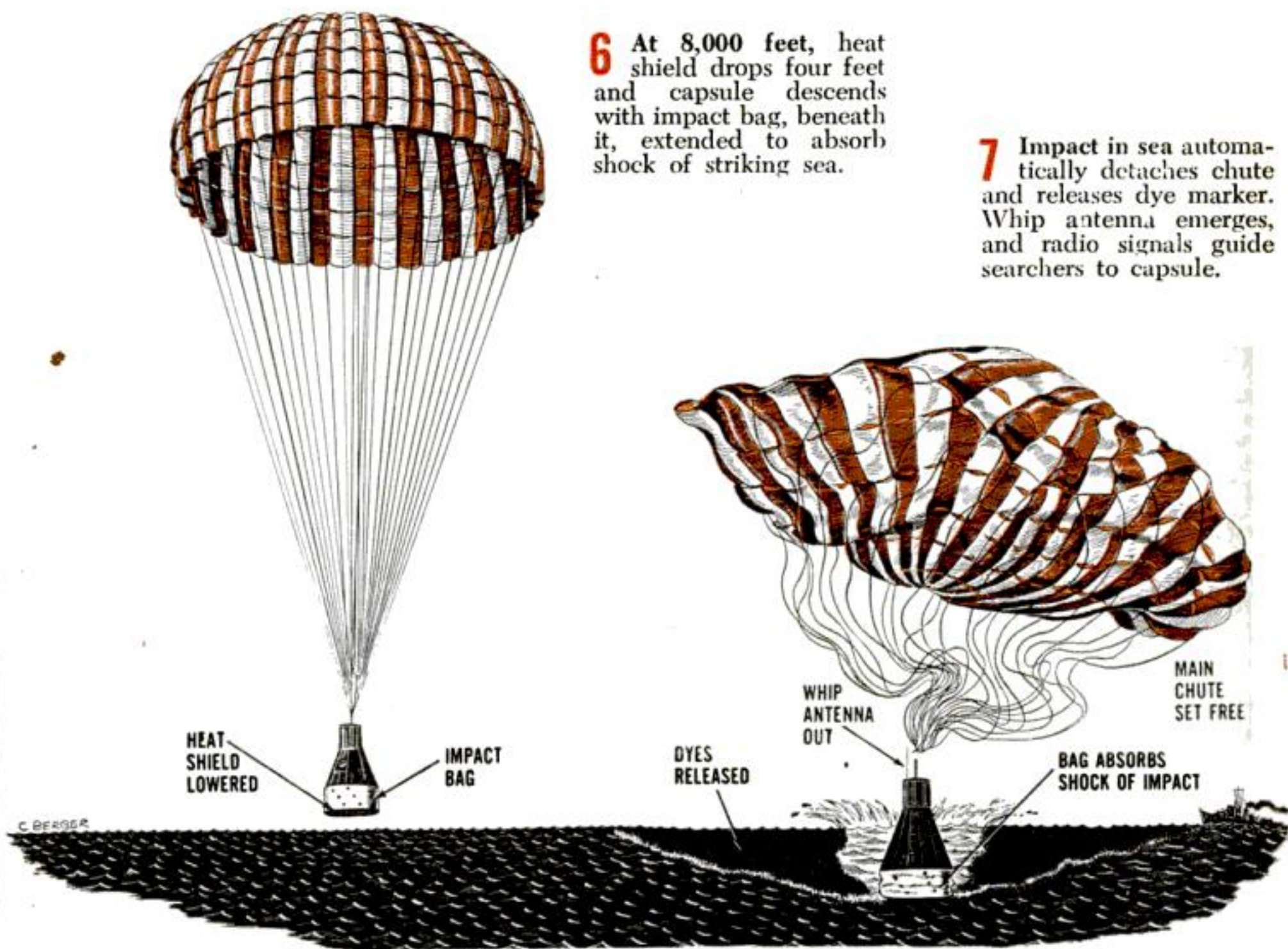
This is the spacecraft's impact bag. Air fills the bag on the way down but can't get out as easily as it got in. Momentarily, as the heat shield strikes the waves, the bag acts like an air cushion.

**On the water.** An inertia switch in the spacecraft senses the landing shock and cuts loose the main chute. If left attached, it might overturn the craft and drown its occupant.

As the spacecraft gently bobs in the ocean swells, the impact bag fills with water. Inside it are powdered dyes—bright green to attract air searchers, black to repel sharks. These dissolve and flood out through the holes in the bag.

The astronaut jettisons his reserve chute. A whip antenna pokes itself out of the half-empty neck of the spacecraft and starts broadcasting sea-air-rescue and homing signals.

Then it's up to the Navy. ■ ■



**6** At 8,000 feet, heat shield drops four feet and capsule descends with impact bag, beneath it, extended to absorb shock of striking sea.

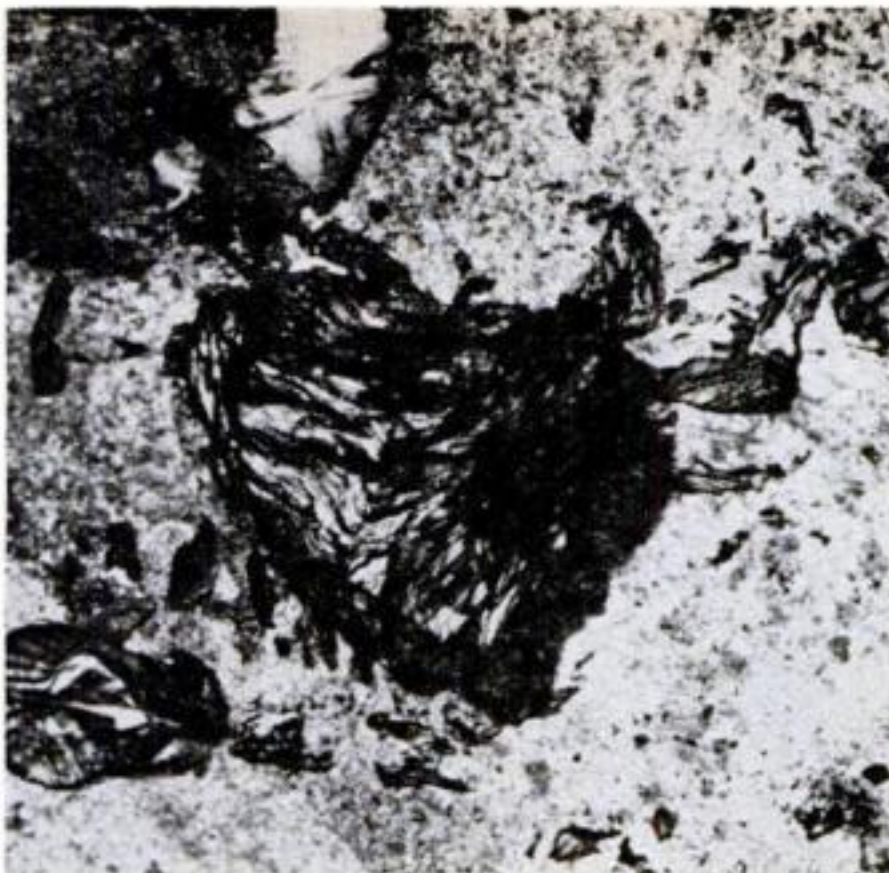
**7** Impact in sea automatically detaches chute and releases dye marker. Whip antenna emerges, and radio signals guide searchers to capsule.



# How the Camera Catches Crooks







Bookies thought they had an out: a fire to burn their dope sheets. But a Connecticut



State Police photographer patched the pieces, took this infrared photo that convicted them.

Would Sherlock Holmes be a camera bug today? Probably, say crime experts, who tie hangman's knots with photo film

By C. P. Gilmore

**A**TALL, blond youth stormed into the post office in a small Texas town, pulled a gun, grabbed \$14,000, and ran. An elderly woman recognized the gunman, told police she had seen him come out of Mrs. Toole's boarding house.

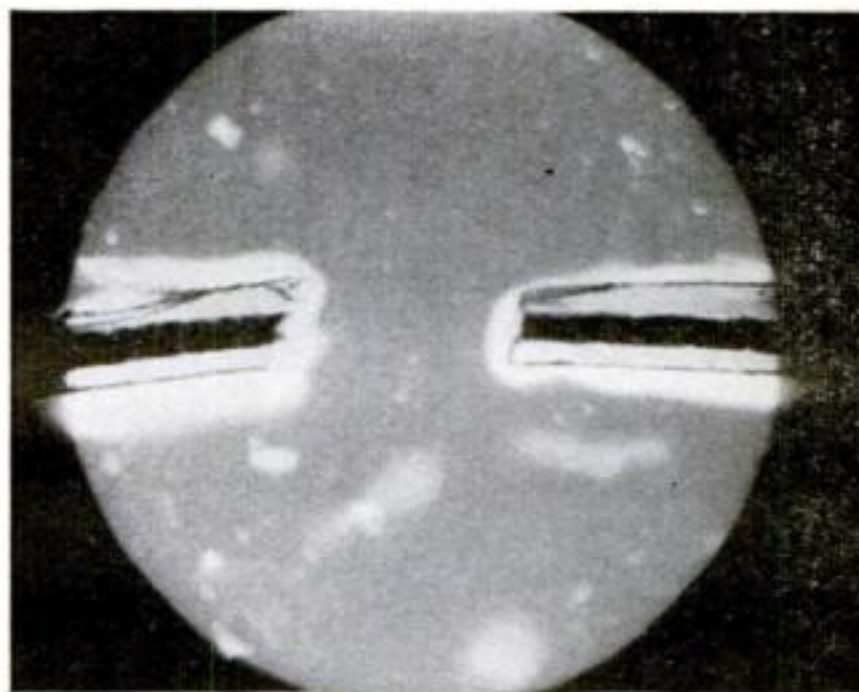
Mrs. Toole led officers to the room of a young man meeting the bandit's description. He was gone. There were no fingerprints. The only clue: a dab of dried shaving lather containing bits of whisker on the washbasin.

A few weeks later a young man was picked up in a nearby town going through a red light. Hauled in for questioning, he denied having lived at Mrs. Toole's, or even having been in that town. Police said nothing, gave him a carefully cleaned electric razor.

When he had shaved, cops packed up samples of beard taken from the razor along with those found in the dried shaving lather, sent them off to Harris Tuttle of Rochester, N.Y., generally recognized as the world's leading authority in the field of crime photography.

Tuttle put two samples under a special microscope, lighted them from behind, and took a picture. It showed that both whiskers were of the same color and size, that the center cores were of the same thickness, and that both samples had identical—and rare—patterns of grooves. Faced with this evidence, the young man confessed.

Photography, as practiced by Tuttle, frequently cracks crimes by bringing out



Convicted by a whisker: A post-office robber broke down when shown blowups of hair found in a razor police let him use and one found in a rooming house. (U.S. Post Office Dept. photo)



## Fancy tricks with ultraviolet and infrared light, or X-rays,

invisible clues. Once a man in Los Angeles wrote a note of introduction for a casual friend. The friend turned out to be not so friendly. He used ink eradicator to get rid of the body of the note, leaving only the signature. Then he typed in a promissory note for \$3,850.

It looked like a perfect job—but not to Tuttle. He put the paper under strong ultraviolet rays, took its picture on special film.

The original message was clearly visible on the photo, and the "friend" was arrested for forgery.

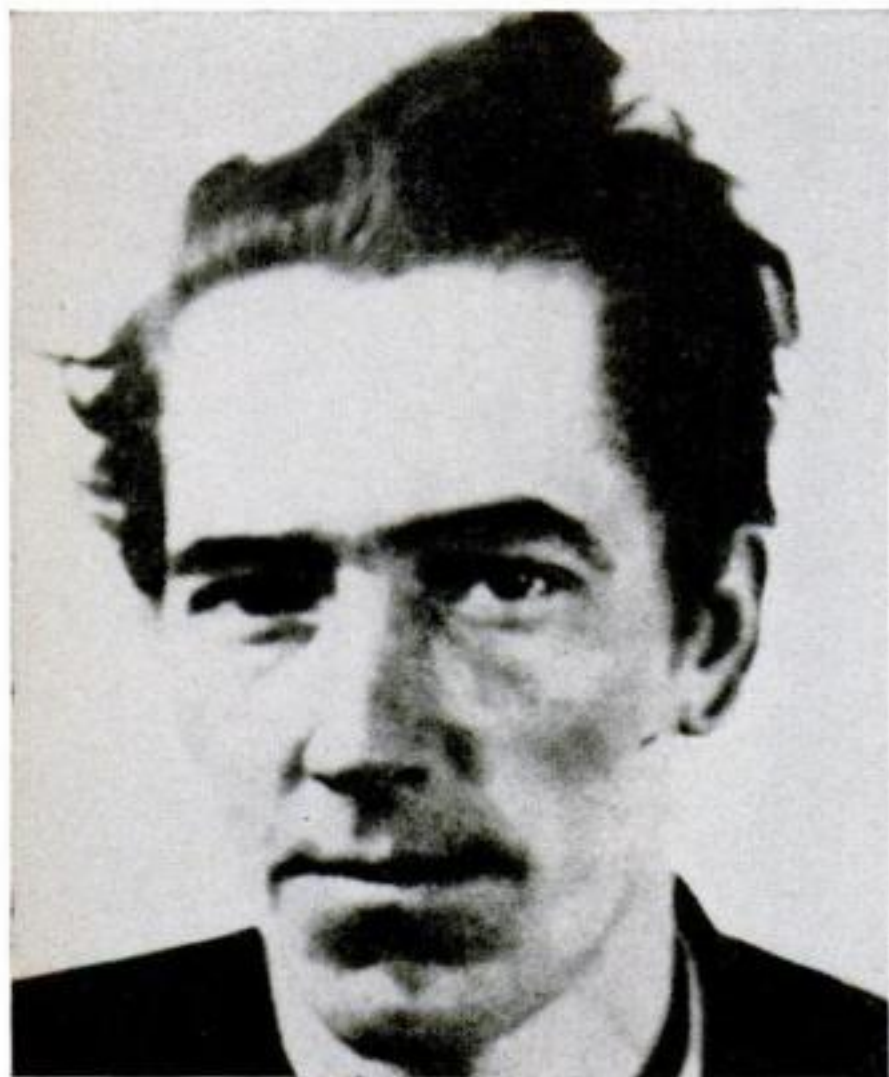
**Tricks to finger felons.** As a long-time consultant on law-enforcement photography for the Eastman Kodak Company, Tuttle has invented and refined scores of such special techniques, processes, and pieces of crime-photography equipment. He uses every photographic trick in the book to finger felons, up to and including the use of soft (low-powered) X-rays.

With soft X-rays, for example, he discovered a way to photograph cigarette paper and identify the brand of ciga-

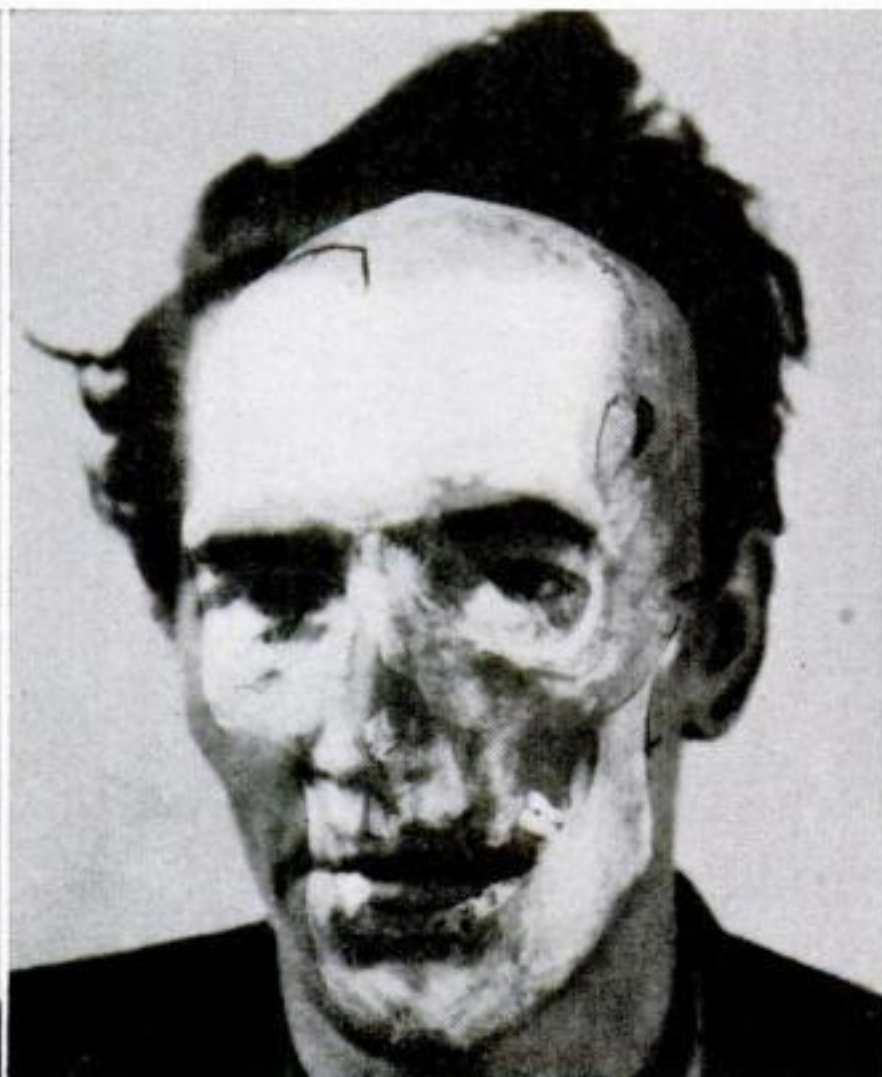


Drunken-driving suspects almost always plead

rette. Tuttle also discovered that tobacco and marijuana make distinctively different soft-X-ray patterns. He can identify and measure the exact amount of marijuana in a cigarette without destroying evidence. Tuttle has also shown how soft X-ray will reveal the presence of meat other than beef in hamburger, distinguish between human blood and animal blood, and separate the finest



The Mounties got their man: A Royal Canadian Mounted Police photographer took angled shots



of a skull found in a creek bed. Skull photo fitted perfectly against photo of a missing man.



help the crime photographer put the finger on a criminal



guilty when shown movies of how they looked when they were brought in. (Posed photos.)

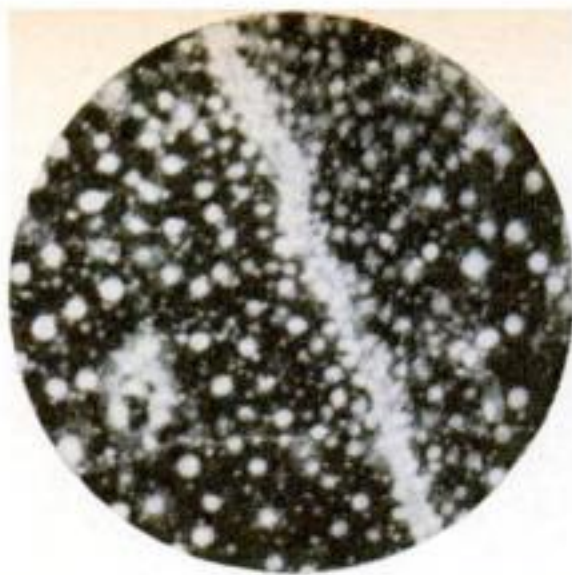
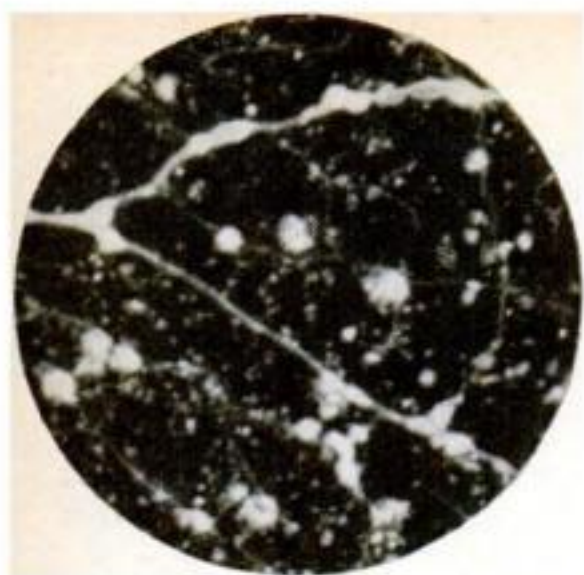


Boys stealing gas from a tank were caught in the act: A New Milford, Conn., police chief

rigged a Rube Goldberg setup of string-mouse-trap-camera-horn that filmed them stealing.

CONTINUED





Marijuana or pure tobacco? Soft-X-ray camera work shows up the striking differences between

tobacco (left) and marijuana (center). Cigarette tested at right contained a mixture.

cultured pearls from true natural ones.

**From sleuth to teacher.** Harris Tuttle, a large, handsome, intense man of about 60 with a dapper gray mustache, used to spend a great deal of his time collecting clues from actual crimes with his camera. Today, most of his time is taken up teaching law-enforcement offi-

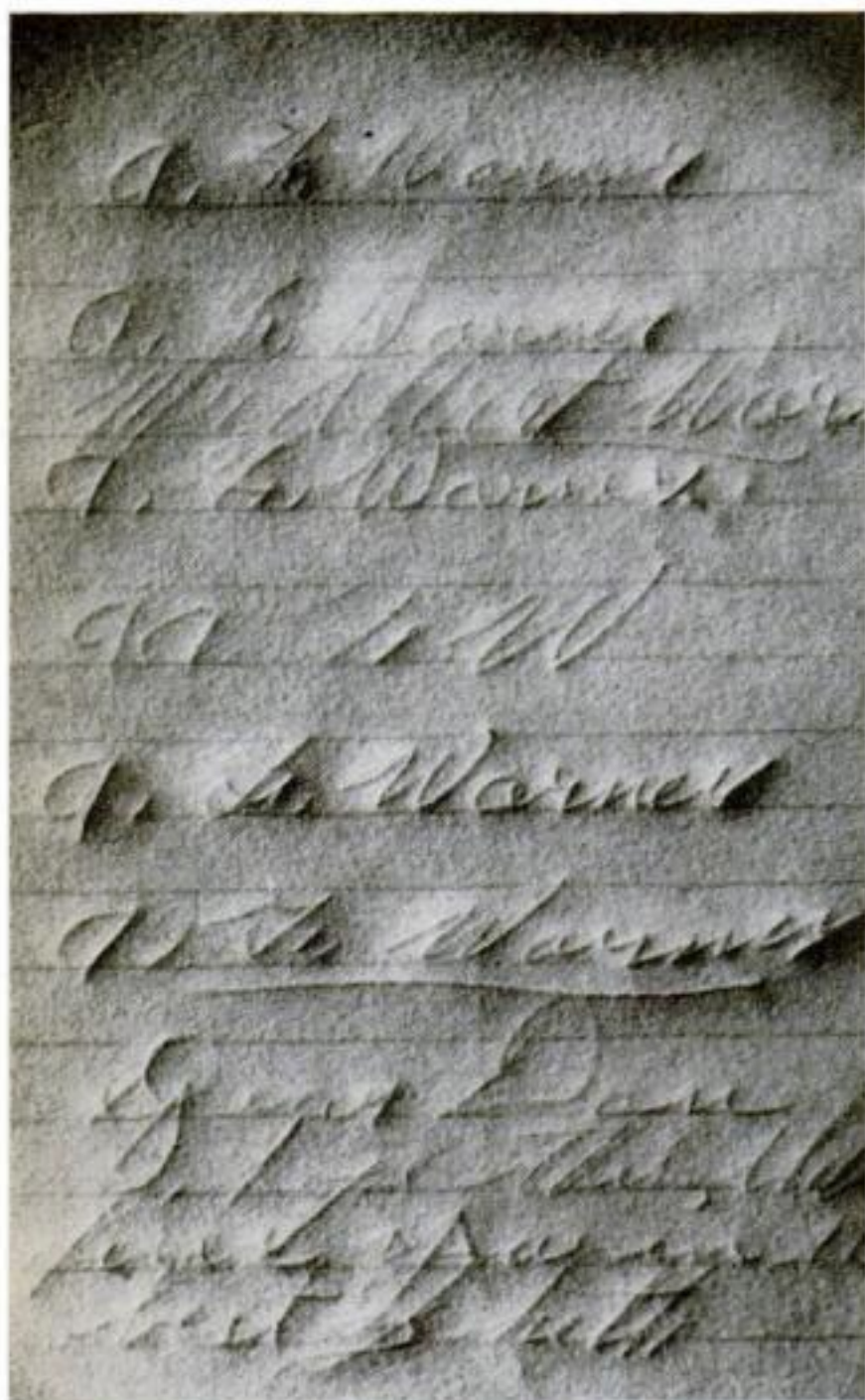
cials the tricks he has learned over a lifetime.

On an average day in his office in Rochester, Tuttle gets at least two or three phone calls and a handful of letters from police around the world with photographic problems.

The police chief of New Milford, Conn., wrote Tuttle not long ago explaining that someone was stealing gasoline from a local distributor's tank truck, but he hadn't been able to catch the thief. Nor did he have the money to set up an elaborate photographic surveillance unit like those in many banks. Tuttle had the answer. He suggested that the chief rig a cheap Brownie camera, a 10-cent mousetrap, and a piece of string. The string was to be stretched across the burglar's path. A slight nudge would set off the mousetrap, tied to one end of the string. The mousetrap would hit the camera's shutter release, fire a flash bulb, and take a picture. It would also close a switch and set off the tank truck's horn, simultaneously calling the police and scaring the crook so he wouldn't try to destroy the camera.

**Caught in the act.** The chief set up the system, heard the horn go off within the first few hours. He woke up the local drugstore owner, who had his own darkroom, and got him to develop the film. An hour later, he had arrested two high-school boys who maintained they had been in bed sleeping all night. They admitted their guilt when the chief pulled out the incriminating photo.

[\[Continued on page 192\]](#)

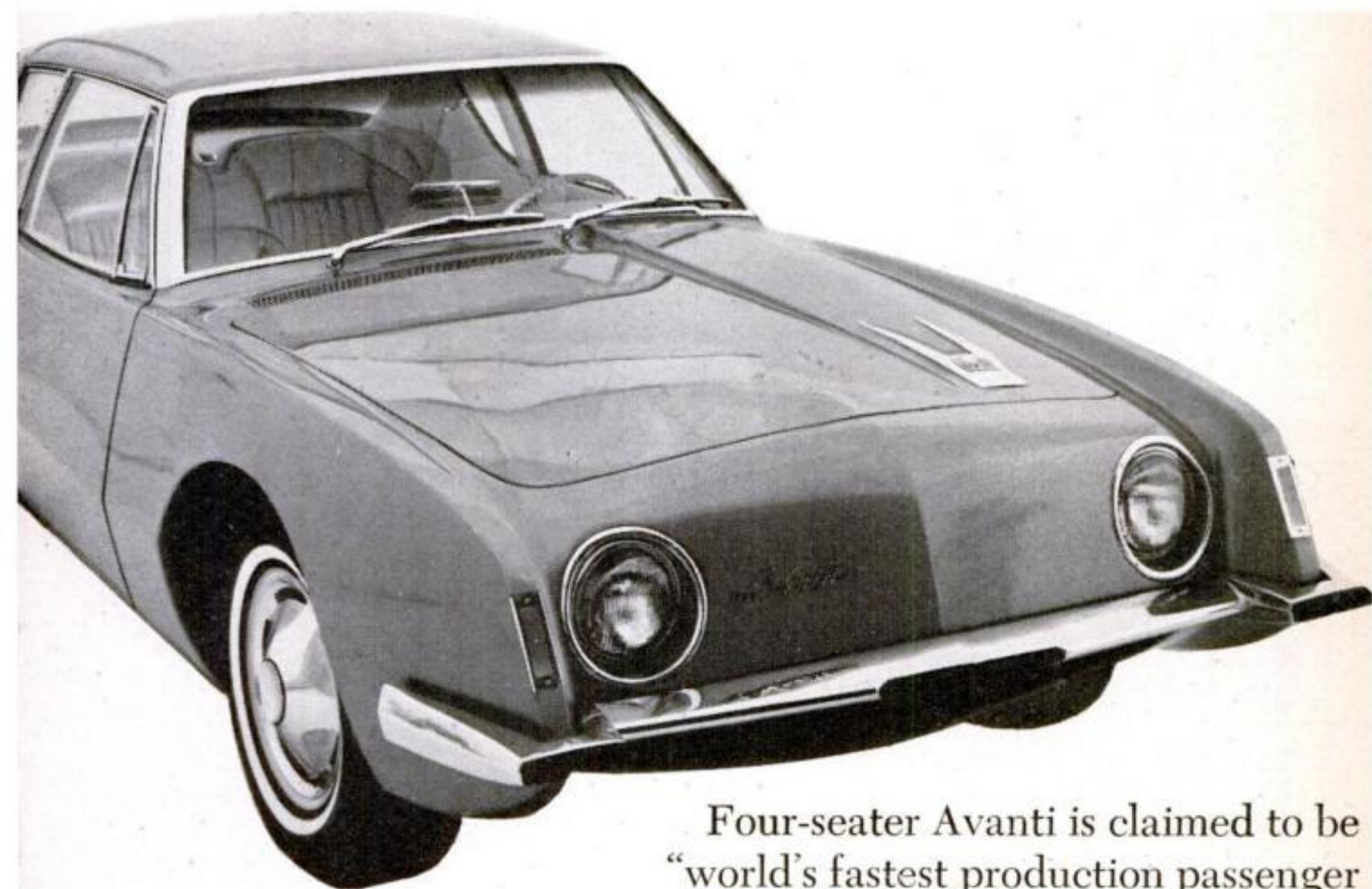


The "blank" top sheet of a pad looked like this when photographed on high-contrast film. San Diego police used the impression left by a torn-off sheet to convict a wife murderer.



# Hot New Studey

## goes after the T-Bird trade



Four-seater Avanti is claimed to be "world's fastest production passenger car." Top speed: 170-plus

**By Devon Francis**

**F**OR the last three months, test drivers at the Studebaker Corp. proving ground a dozen miles west of South Bend, Ind., have been scaring the daylights out of the deer that roam its thickets. They have been driving prototypes of a new car that sounds like a jet airplane run amuck. The analogy isn't far off—these things will reach 60 miles an hour from a standing start in about the time it takes you to draw three breaths.

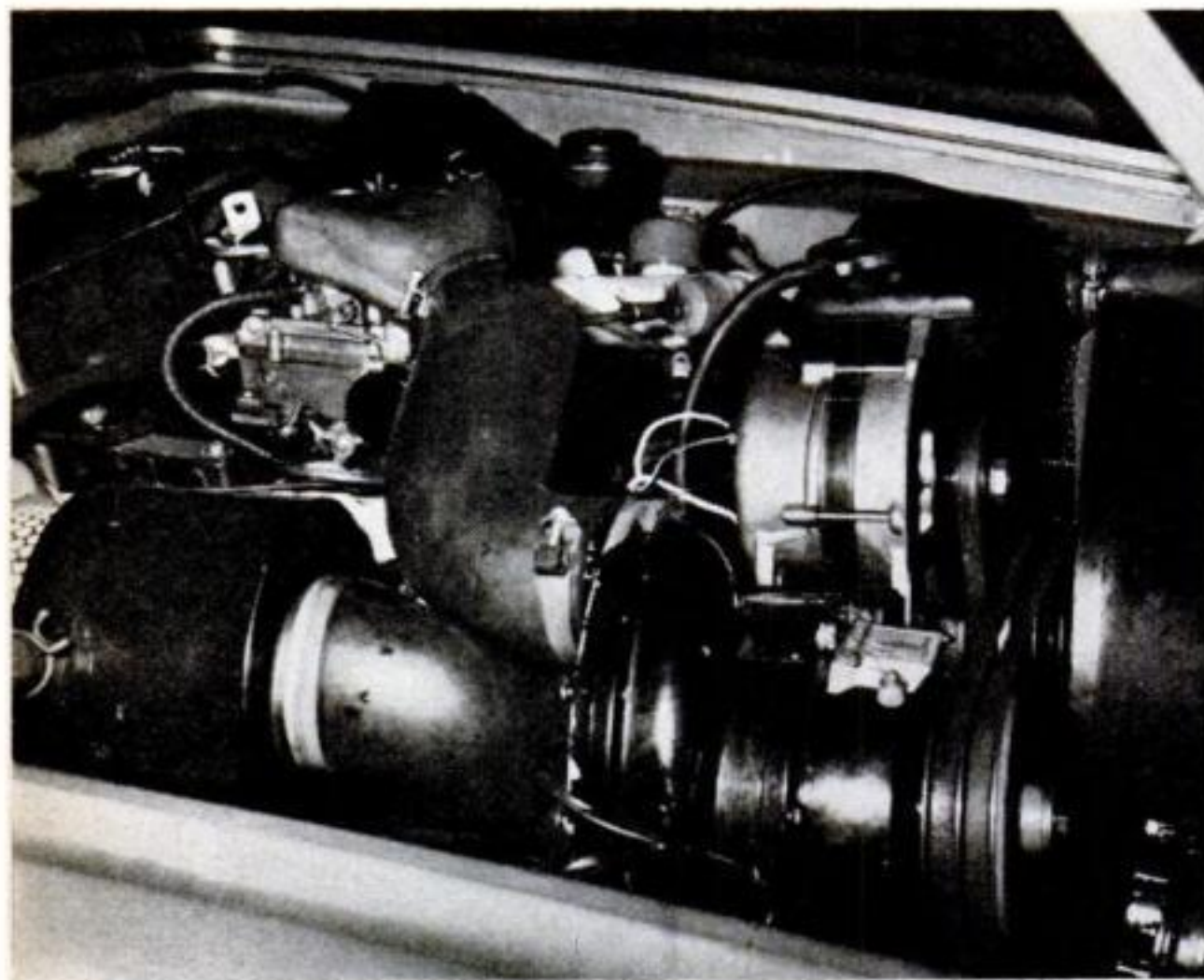
The new Studebaker, first of the 1963 cars to appear, does not replace the standard Lark. It's a "sports-type" automobile like the Chrysler 300 and the Ford Thunderbird. While the body, like that of the Chevrolet Corvette, is made of fiber-

CONTINUED

55



## Avanti, Studebaker's most radically styled car in 16 years, hits



View under hood shows supercharger, right foreground. Pipe leading from it to top of engine pressurizes four-barrel carb. Blower runs at six times crankshaft speed — 30,000 r.p.m. when engine reaches its top horsepower at 5,000 r.p.m. Forty-amp alternator is standard. Clutch on radiator fan limits its speed to 2,500 r.p.m., to save power in higher speed ranges. Standard axle ratio is 3.73. Several options are available, from 3.07 to 4.09. Braking is divided 62 percent at the front 38 at rear.

glass. there is no pretense that it's a true sports or competition car.

Studebaker has produced the most radical-looking car since the famous post-World War II model with the glass all around. That was the one that, as the joke went, "You can't tell whether it's coming or going."

There's no doubt about this one. It goes.

I drove it. With a supercharged engine and an automatic transmission in Drive. I clocked 60 m.p.h. in 6.7 seconds. At that, the mechanic who rode with me complained, "She's not perking just right."

The 300 takes 8.3 seconds to reach 60, the Thunderbird 10.5 seconds.

I reached an indicated 100 m.p.h. in the Avanti, as Studebaker has christened its new vehicle, in a shade under 18 seconds. Top speed: 125 m.p.h. With an optional power kit—including hot cam, higher compression, and overbore for an extra 10 cu. in.—a supercharged Avanti with a 3.07 rear end has been clocked at 171.1 m.p.h.

**How it stacks up.** Other comparisons between the new Studebaker and the

other two sports-type cars (based on estimates because Studebaker refuses to release horsepower figures):

Horsepower per cubic inch of piston displacement—Avanti, 1.04; 300, .92; Thunderbird, .77.

Pounds of car weight per horsepower—Avanti, 10.3; 300, 10.4; T-bird, 14.2.

The engine is the top Studebaker V-8, with a piston displacement of 289 cubic inches. This engine is standard on the Hawk, optional on the Lark Cruiser. It is souped up to provide 245 hp., and an additional 55 hp. with an optional, belt-driven supercharger. The supercharger provides up to five extra pounds of air.

The standard transmission is a three-speed manual. An automatic and a four-speed manual are optional.

Sturdy springs give the Avanti a somewhat stiffer ride than the family sedan. Yet good shock absorbers save you from a pounding on rough roads. Stabilizing rods tie the chassis to the body on corners. You can take a 40-mile curve at 60 with barely any body lean.

The brakes—disks in front, drums in the rear—are so sure, so beautifully balanced, that I could jam them on full at



## 60 m.p.h. in 6.7 seconds

100 miles an hour with my hands off the wheel. The skid marks were as true as an arrow's flight.

**The outside.** If anything, in looks and appointments the new Studebaker is even more startling than the one of 16 years ago. The Avanti—which means “Forward” in Italian—looks as if it had come right out of a Milan studio. There is not a straight line on it except for two little oblongs that frame the parking lights.

In place of a grille there is an air scoop under the bumper. The glass in the doors curves inward, as in the Imperial and Lincoln Continental.

The four seats are, of course, buckets, with a console between them where the transmission lever is mounted. A padded rollover bar snugs up against the roof.

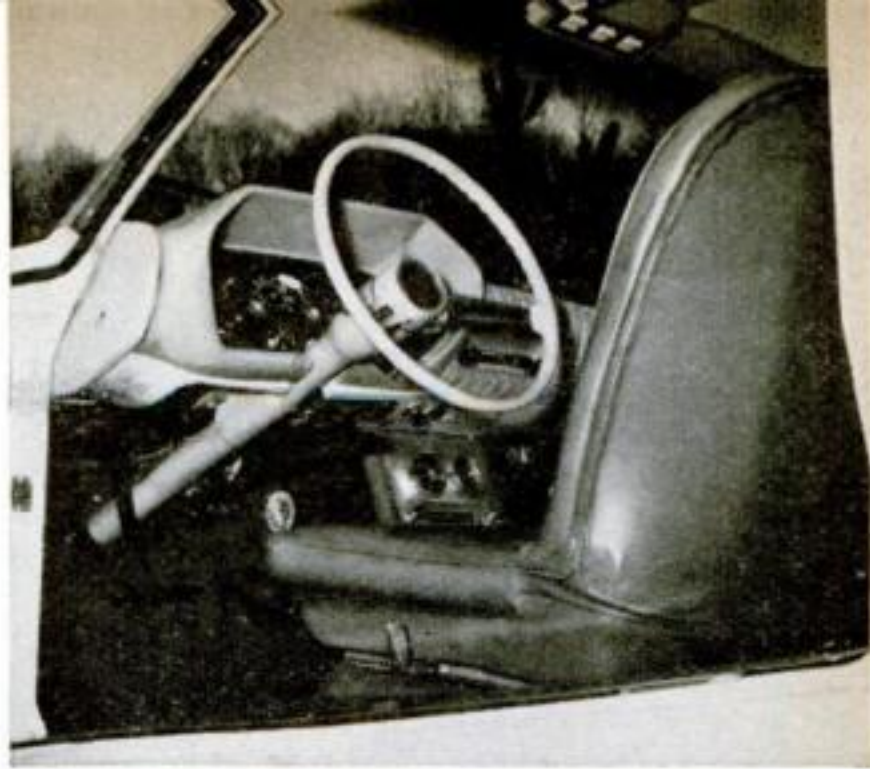
Light and heater controls are above the windshield. The instruments include a tachometer and, in the case of supercharging, a manifold-vacuum dial that shows how much boost you are pulling from the pump.

**Why the new look?** All this doesn't sound much like the good, gray, conservative Studebaker of recent vintage. It isn't. The product has a new look because Studebaker's new president, Sherwood Harry Egbert, lusted for a prestige car in the company stable.

Egbert is a bouncy man, standing six feet four, an airplane pilot, former star football player, and ex-Marine.

Last year he called in Raymond Loewy, the man who styled the Studebaker in 1946. Egbert had been doodling with a pencil. He shoved a sketch at Loewy. “Give me,” said he, “something like this.”

What Loewy produced is a high-style car that will have a strong appeal for those who want a high-powered car that's “way out” in styling. While Studebaker has said nothing as yet about price, the Avanti no doubt will retail for a few hundred dollars less than the Thunderbird, or about \$4,000. ■ ■



A red glow backgrounds instruments and controls at night, imitating an airplane panel. Locking doors buttons up everything: Releases for both hood and trunk are inside the car.



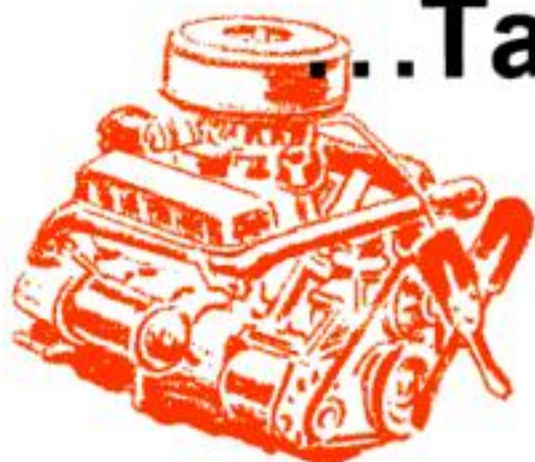
Cropped stern still provides 15.7 cu. ft. in trunk. Built on same wheelbase as Lark—109 inches—Avanti at 192.4 inches is four inches shorter overall. Height is 53.8 inches, width is 70.3.



High gas-filler door leads to 21-gallon tank. Big 15-inch wheels give car racy look. Power steering or special manual-steering kit cuts standard 22:1 ratio to relatively fast 16:1.



# Horsepower or Economy ...Take Your Choice



From 80 horses to 400,  
you have a smörgåsbord of  
automobile-engine options

By Devon Francis

**I**F SOMEONE were to ask you to make a guess on the number of horsepower options being offered the U.S. motorist these days, which of these figures would you choose: 30? 45? 60? 80?

If you guessed 80, you would just about hit it on the button. Actually, there are 81—by far the biggest choice of horsepower in the history of the American highway. These are variations on 36 basic engine sizes. The differences come from carburetion, compression ratios, special camshafts, and engine speeds at which the power peaks.

Pay your money and take your choice: You can have a low-horsepower economy job or a bellowing engine that slurps up gasoline as if it were free.

The horsepowers range from a modest 80 (for the standard Corvair) to a whopping 410 (for a competition Plymouth). On the bleak, limited-performance side, you can have American Motors' 90 horsepower, Chrysler Corps.'s 155, Ford's 134 and 156, General Motors' 80, 84, 90, and 120, and Studebaker's 154.

In high power, the sky's the limit. One engine, a still-more-competitive Plymouth with a horsepower that's not even disclosed, burns nothing but aviation fuel at a compression ratio of no less than 13:1.

The accompanying chart tells the story of the fabulous range of horsepower options available for 1962. And 1963? Even bigger.

## ADDITIONAL OPTIONS:

Abbreviations: Std. = standard. Opt. = optional. Bbl. = barrels. C.R. = compression ratio. R = regular. P = premium.

- A. Opt. on Classic: 138 hp. @ 4,500 r.p.m. with 2-bbl. carb.
- B. Opt.: 270 hp. @ 4,700 r.p.m. at 9.7:1 c.r. with 4-bbl. carb.
- C. Opt. on Lancer, Valiant: 115 hp. @ 4,600 r.p.m. at 8.7 c.r. with 4-bbl. carb.
- D. Opt. on Dart, Lancer, Valiant: 155 hp. @ 4,000 r.p.m. at 7.6:1 c.r. with 4-bbl. carb.
- E. Opt. on Dart, Plymouth: 260 hp. @ 4,400 r.p.m. at 9:1 c.r. with 4-bbl. carb.
- F. Std. on Dodge Polara, opt. on Dart, Plymouth: 305 hp. @ 4,800 r.p.m. at 9:1 c.r. with 4-bbl. carb. Further opt. on Dart, Newport, Polara, Plymouth: 310 hp. @ 5,200 r.p.m. at 8.3:1 c.r. with two 4-bbl.

carbs. or three 2-bbl. carbs.

- G. Opt. on Dart: 330 hp. @ 5,200 r.p.m. at 9:1 c.r. with 4-bbl. carb.
- H. Std. on 300-H, opt. on 300: 380 hp. @ 5,200 r.p.m. at 10:1 c.r. with two 4-bbl. carbs. Opt. on Dart: 360 hp. @ 5,200 r.p.m. at 9.25:1 c.r. with two 4-bbl. carbs.; 375 hp. @ 5,000 r.p.m. at 9.25:1 c.r. with 4-bbl. carb. Opt. on Plymouth: 410 hp. @ 4,800 r.p.m. at 11:1 c.r. with two 4-bbl. carbs.
- I. Opt. on Galaxie: 375 hp. @ 6,000 r.p.m. at 10.6:1 c.r. with 4-bbl. carb.; 401 hp. @ 6,000 r.p.m. at 10.6:1 c.r. with three 2-bbl. carbs. Opt. on Thunderbird: 340 hp. @ 5,000 r.p.m. at 10.5:1 c.r. with three 2-bbl. carbs.
- J. Opt. on Galaxie, Monterey: 405 hp. @ 5,800 r.p.m. at 10.9:1 c.r. with three 2-bbl. carbs.
- K. Std. with Powerglide: 84 hp. @ 4,400 r.p.m. at 8:1 c.r., same carburetion. Opt. on Monza: 102 hp. @ 4,400 r.p.m. at 9:1 c.r.; 150 hp. @ 4,400 r.p.m. at

	TYPE
AMERICAN MOTORS	In-line 6
	In-line 6
	V-8
CHRYSLER CORP.	In-line 6
	In-line 6
	V-8
	V-8
	V-8
	V-8
FORD MOTOR CO.	In-line 6
	In-line 6
	V-8
	In-line 6
	V-8
	V-8
	V-8
	V-8
	V-8
GENERAL MOTORS	Flat 6
	In-line 4
	In-line 6
	In-line 4
	V-6
	V-8
	In-line 6
	V-8
	V-8
	V-8
	V-8
	V-8
	V-8
STUDEBAKER-PACKARD	In-line 6
	V-8
	V-8



DISPLACE- MENT (cu. in.)	BORE & STROKE (in.)	COMPRESSION RATIO (:1)	CARBURETION (no. of barrels)	HP. @ R.P.M.	ADDITIONAL OPTIONS	TORQUE @ R.P.M. (lb./ft.)	FUEL REQUIRED	
195.6	3.12x4.25	8	1	90 @ 3,800		160 @ 1,600	R	Std.: American
195.6	3.12x4.25	8.7	1	125 @ 4,200	A	180 @ 1,600	R	Std.: Classic; opt.: American
327	4x3.25	8.7	2	250 @ 4,700	B	340 @ 2,600	R	Std.: Ambassador
170	3.4x3.12	8.2	1	101 @ 4,400	C	155 @ 2,400	R	Std.: Lancer, Valiant
225	3.4x4.12	8.2	1	145 @ 4,000	D	215 @ 2,800	R	Std.: Dart, Plymouth; opt.: Lancer, Valiant
318	3.91x3.31	9	2	230 @ 4,400	E	340 @ 2,400	R	Std.: Dart V-8; opt.: Plymouth
361	4.12x3.38	9	2	265 @ 4,400	F	380 @ 2,400	R	Std.: Newport
383	4.25x3.38	9	2	325 @ 4,600	G	425 @ 2,800	R	Std.: 300; opt.: Dart
413	4.18x3.75	10	4	340 @ 4,600	H	470 @ 2,800	P	Std.: New Yorker, Imperial; opt.: 300
144	3.5x2.5	8.7	1	85 @ 4,200		134 @ 2,000	R	Std.: Falcon, Comet
170	3.5x2.94	8.7	1	101 @ 4,400		156 @ 2,400	R	Std.: Fairlane, Meteor; opt.: Falcon, Comet
221	3.5x2.87	8.7	2	145 @ 4,400		216 @ 2,200	R	Opt.: Fairlane, Meteor
223	3.62x3.6	8.4	1	138 @ 4,200		203 @ 2,200	R	Std.: Galaxie; opt.: Monterey
260	3.8x2.87	8.7	2	164 @ 4,400		258 @ 2,200	R	Opt.: Fairlane, Meteor
292	3.75x3.3	8.8	2	170 @ 4,200		279 @ 2,200	R	Opt.: Monterey
352	4x3.5	8.9	2	220 @ 4,300		336 @ 2,600	R	Opt.: Galaxie, Monterey
390	4.05x3.78	9.6	4	300 @ 4,600	I	427 @ 2,800	P	Std.: Thunderbird; opt.: Galaxie, Monterey
406	4.13x3.78	10.9	4	385 @ 5,800	J	444 @ 3,400	P	Opt.: Galaxie, Monterey
430	4.3x3.7	10	2	300 @ 4,100		465 @ 2,000	P	Std.: Continental
145	3.43x2.6	8	1	80 @ 4,400	K	128 @ 2,300	R	Std.: Corvair
153	3.88x3.25	8.5	1	90 @ 4,000		152 @ 2,400	R	Std.: Chevy II
194	3.56x3.25	8.5	1	120 @ 4,400		177 @ 2,400	R	Opt.: Chevy II
194.5	4.06x3.75	8.6	1	110 @ 3,800	L	190 @ 2,000	R	Std.: Tempest
198	3.62x3.2	8.8	2	135 @ 4,600		205 @ 2,400	R	Std.: Buick Special
215	3.5x2.8	8.8	2	155 @ 4,600	M	220 @ 2,400	R	Std.: F-85; opt.: Special
235.5	3.56x3.94	8.25	1	135 @ 4,000		217 @ 2,000	R	Std.: Chevrolet
283	3.87x3.0	8.5	2	170 @ 4,200		275 @ 2,200	R	Opt.: Chevrolet
327	4.0x3.25	10.5	4	250 @ 4,400	N	350 @ 2,800	P	Std.: Corvette; opt.: Chevrolet
389	4.06x3.75	8.6	2	215 @ 3,600	O	390 @ 2,000	R	Std.: Pontiac
390	4.0x3.87	10.5	4	325 @ 4,800		430 @ 3,100	P	Std.: Cadillac
394	4.12x3.68	10.25	2	280 @ 4,400	P	430 @ 2,400	P	Std.: Olds 88
401	4.18x3.64	9	2	265 @ 4,400	Q	412 @ 2,400	P	Std.: Buick
409	4.31x3.5	11	4	380 @ 5,800	R	420 @ 3,200	P	Opt.: Chevrolet
170	3x4	8.25	1	112 @ 4,500		154 @ 2,000	R	Std.: Lark
259.2	3.56x3.25	8.5	2	180 @ 4,500	S	260 @ 2,800	R	Std.: Lark Cruiser; opt.: other models
289	3.56x3.62	8.5	2	210 @ 4,500	T	300 @ 2,800	R	Std.: Hawk; opt.: Cruiser

8:1 c.r. supercharged.

- L. 115 hp. with automatic transmission. Opt.: 120 hp. @ 3,800 r.p.m. at 10.25:1 c.r.; 140 hp. @ 4,400 r.p.m. with automatic transmission; 166 hp. @ 4,800 r.p.m. at 10.25:1 c.r. with 4-bbl. carb.
- M. Opt. on Buick Skylark and Tempest: 190 hp. @ 4,800 r.p.m. at 11:1 c.r. with 4-bbl. carb. Opt. on Olds Cutlass: 185 hp. at 4,800 r.p.m. at 10.25:1 c.r. with 4-bbl. carb. Opt. on F-85: 215 hp. @ 4,600 r.p.m. at 10.25:1 c.r. supercharged.
- N. Opt. on Chevrolet, Corvette: 300 hp. @ 5,000 r.p.m. at 10.25:1 c.r. with 4-bbl. carb. Opt. on Corvette: 340 hp. @ 6,000 r.p.m. at 11.25:1 c.r. with 4-bbl. carb., special camshaft; 360 hp. @ 6,000 r.p.m. at 11.25:1 c.r. with fuel injection.
- O. Opts.: 230 hp. @ 4,000 r.p.m. at 8.6:1 c.r. with 2-bbl. carb.; 235 hp. @ 3,600 r.p.m. at 8.6:1 c.r. with 4-bbl. carb.; 267 hp. @ 4,200 r.p.m. at 10.25:1

c.r. with 2-bbl. carb.; 283 hp. @ 4,400 r.p.m. at 10.25:1 c.r. with 2-bbl. carb.; 303 hp. @ 4,600 r.p.m. at 10.25:1 c.r. with 4-bbl. carb.; 318 hp. @ 4,600 r.p.m. at 10.75:1 c.r. with three 2-bbl. carbs.; 333 hp. @ 4,800 r.p.m. at 10.75:1 c.r. with 4-bbl. carb.; 348 hp. @ 4,800 r.p.m. at 10.75:1 c.r. with three 2-bbl. carbs.

- P. Olds 98 options: 260 hp. @ 4,400 r.p.m. at 8.75:1 c.r. with 2-bbl. carb.; 330 hp. @ 4,600 r.p.m. at 10.25:1 c.r. with 4-bbl. carb. Opt. on Starfire: 345 hp. @ 3,800 r.p.m. at 10.5:1 c.r. with 4-bbl. carb.
- Q. Opts.: 280 hp. @ 4,400 r.p.m. at 10.25:1 c.r. with 2-bbl. carb.; 325 hp. @ 4,400 r.p.m. at 10.25:1 c.r. with 4-bbl. carb.
- R. Opt.: 409 hp. @ 6,000 r.p.m. at 11:1 c.r. with two 4-bbl. carbs.
- S. Opt.: 195 hp. @ 4,500 r.p.m. with 4-bbl. carb.
- T. Opt.: 225 hp. @ 4,500 r.p.m. with 4-bbl. carb.





Mobile swimming pool and auxiliary van are parked for children's use at local playground.



Pool is filled from fire hydrant. At day's end, water is let out by pulling a drain plug.



On the mats, kids improve balance and agility. They also learn to chin, run, throw, and jump.

## Swimming pool and outdoor gym take to the road

A two-unit Fun Mobile takes swimming to the children of Linden, N.J., for a 10-week summer program. An 8-by-20-foot pool, 3½ feet deep, was built of steel and marine plywood, lined with plastic, and

mounted on a truck trailer. It can hold 25 kids. The second unit, a big van, carries gym equipment and serves as a bath house. While one group of kids swims, the rest get other physical-fitness instruction.



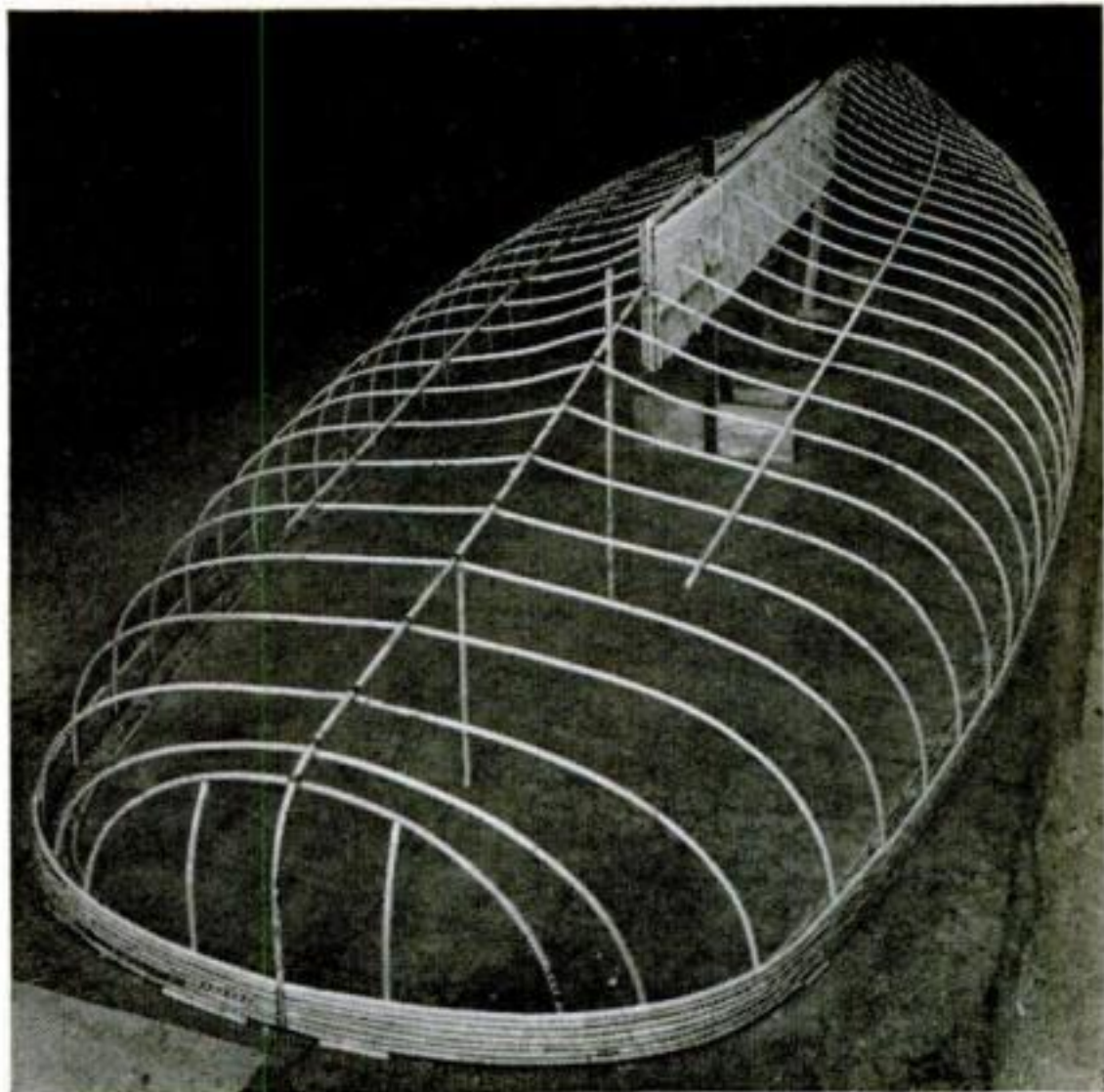
### Rear-view mirror retracts into fender

The rear-view mirror of this Welsh-built Gilbern Mark 1 folds into the fender to reduce wind drag and noise at high speeds. It was installed by the owner. Warm air from the disk brake clears it of condensation and raindrops when it is folded. The sedan is powered by an MGA 1600 engine good for a top speed of 95 m.p.h.





**Afloat**, the No Hurry—so named because of building time—is tight as a teacup. Right: the frame.



### Afloat in a paper boat

Made entirely of paper, this sailboat doesn't swell and won't sink, says its builder, John Hookman of Cambridge, England. The body—ribs, gunwales, keel, and floorboards—consists of 13,000 tubes that Hook-

man made by impregnating newspaper with synthetic-resin adhesive and rolling it on a mandrel. He bent them to shape before the glue set and joined them with dowels. Twelve layers of newspaper form the boat's skin; mast and boom are of rolled kraft paper. The boat weighs 300 pounds.



### Moving day for a big boat

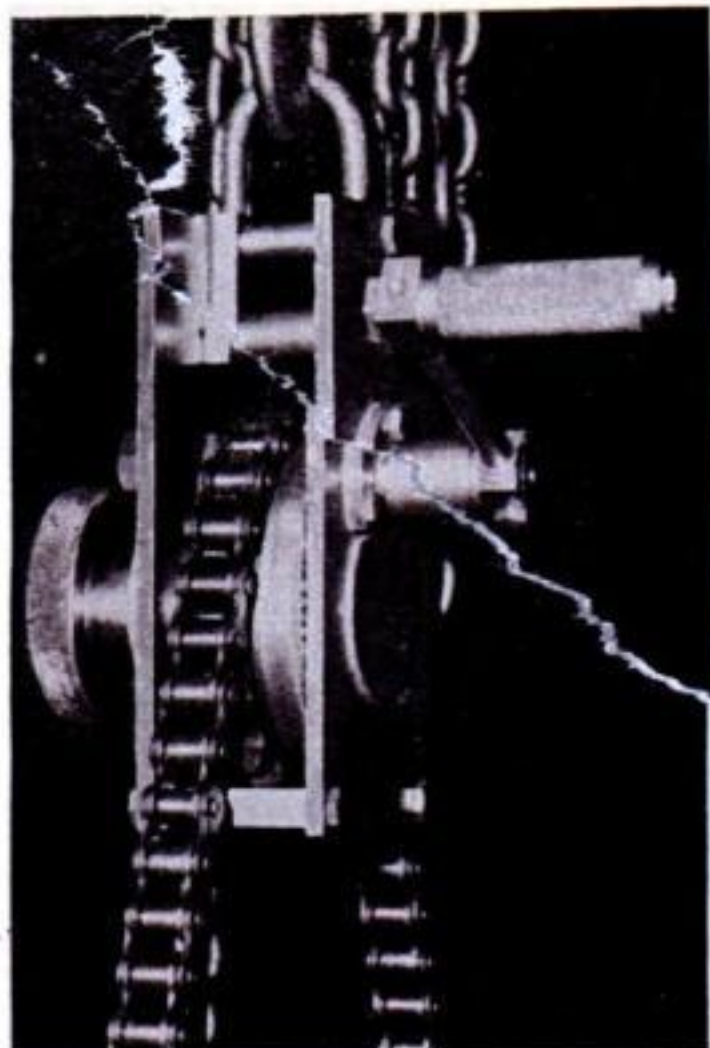
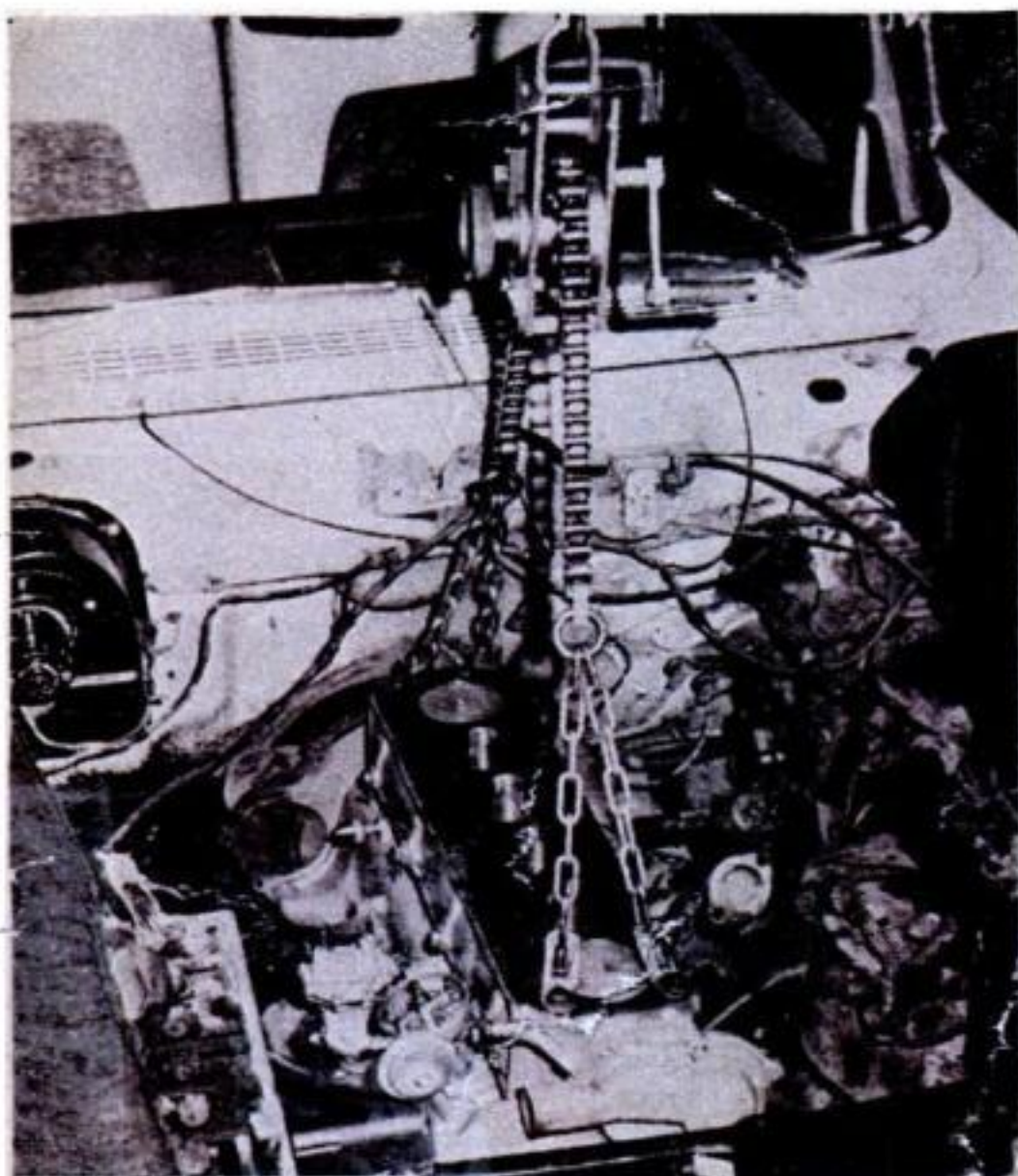
How do you load a 52-foot boat aboard a 25-foot trailer? This one was jacked up to let the trailer run under it, and a supporting frame was then built around it. With motorcycle police to keep traffic clear of the overhang, it rode 200 miles across England to Southampton at 40 m.p.h. There it was jacked up again and launched.



### Home and baby travel with her

Believing a woman's place is in the home—even on the road—Mrs. Clara Hicks, a Los Angeles consignment trucker, had her home mounted between her truck's cab and trailer. A second woman shares driving and caring for 1½-year-old April Hicks on cross-country trips between California and major East Coast cities.





**Knurled crank** is attached to a 12-tooth pinion gear that meshes with a 48-tooth drive gear. Sprockets on the drive gear run a roller chain.

### **Load leveler takes muscle strain out of engine installations**

This tilting attachment for a chain hoist makes car-engine installations a one-man job. Tilting and leveling, which ordinarily involve unhooking the engine several times, are done easily and precisely by turning a hand crank. With four link chains bolted

on, the engine is lifted, tilted, and then locked in position by a hand brake. The tilter can also be used on beams and other heavy loads, and can tilt them to a nearly vertical position. It's made by B B & W Machine Products, Pendleton, Ore.



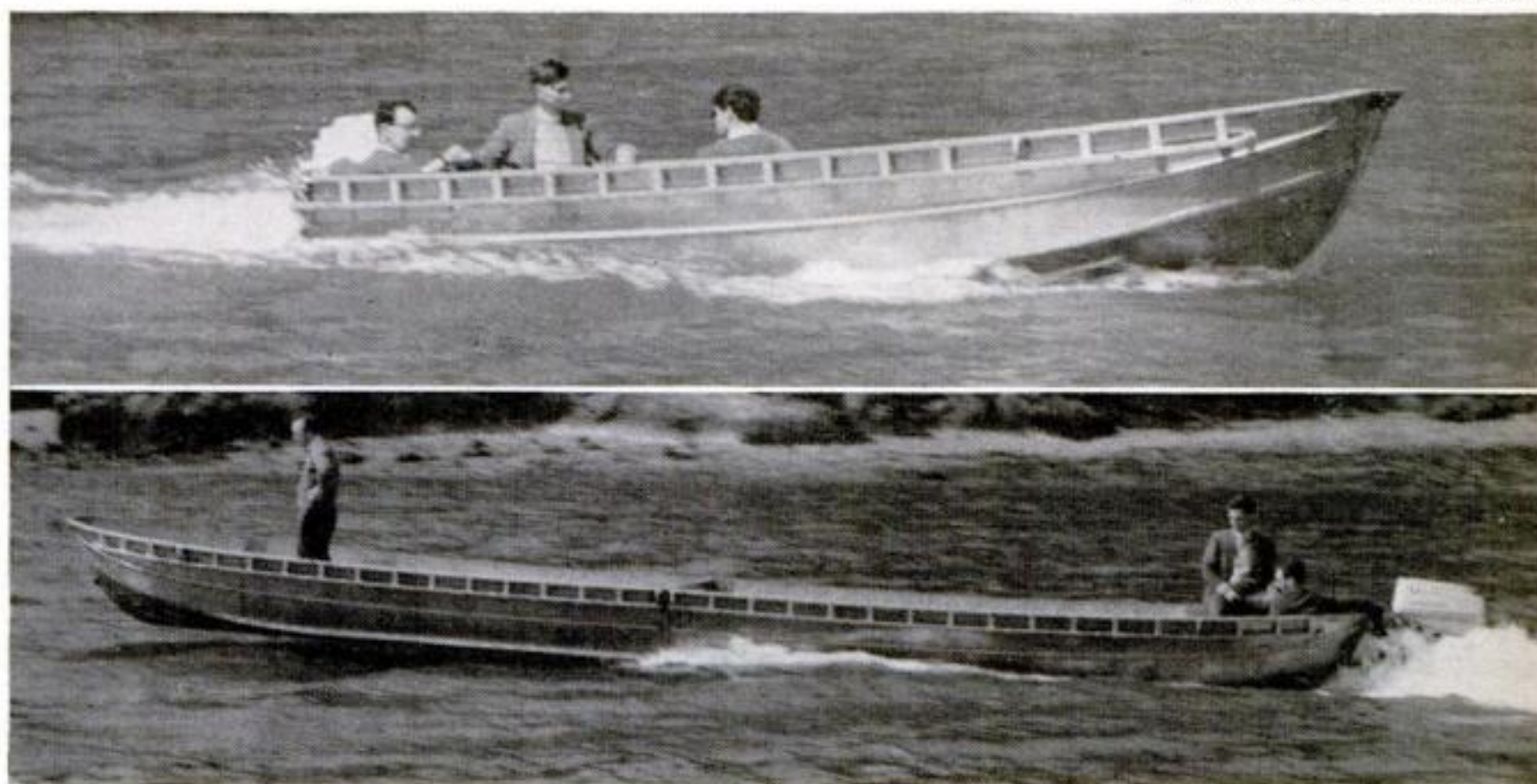
### **Extra eye for plane watchers**

With a small electronic viewer (left) strapped to his head, a controller in an airport tower can keep one eye on radar while doing other jobs.

The device is a cathode-ray tube in an L-shaped housing, with a transparent mirror—resembling a slanted monocle—at one end. The wearer sees through the mirror at the same time that he sees a TV image on the mirror.

The Hughes Electrocular could be useful for tank gunners, airplane pilots, space explorers, and industrial workers.





Single boat (top) takes outboard on transom. On double boat it's mounted on squared-off end.

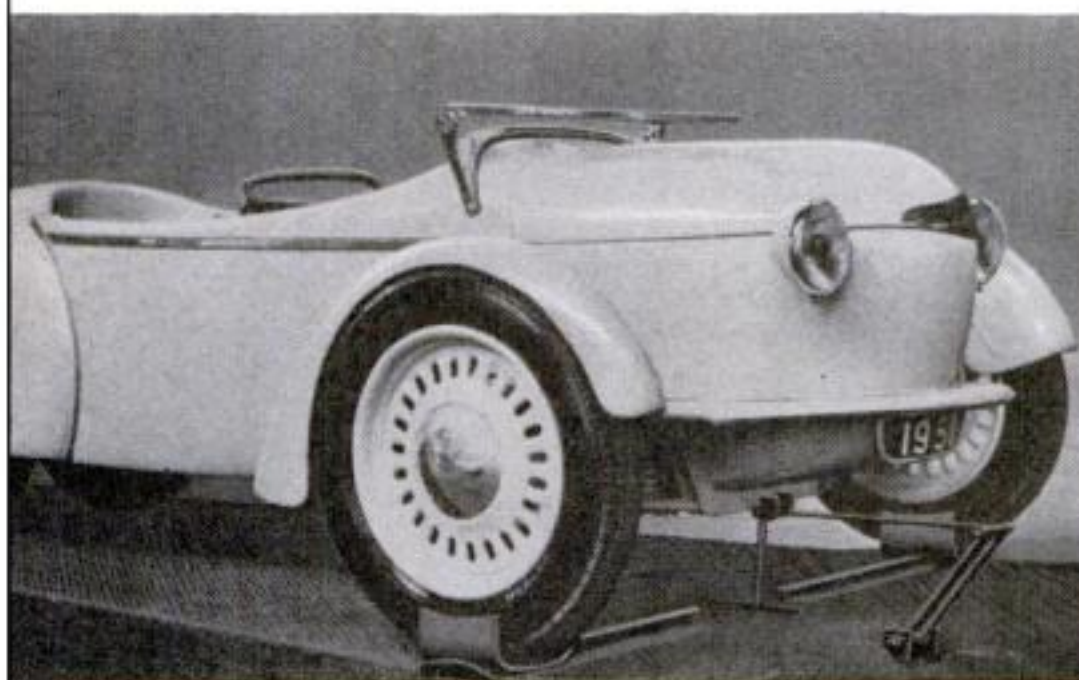
### New boat hulls can team up or go it alone

A 17½-foot British boat with an aluminum-alloy skin is designed for both single and multiple use. With a 40-hp. outboard on its transom, it can do 23 miles an hour. Coupled stern to stern with hinge pins, two hulls make a boat with twice the capacity. For military or other emergency needs, two or more coupled pairs can be fastened side by side through gunwale eyes to make a barge or vehicle-carrying ferry.

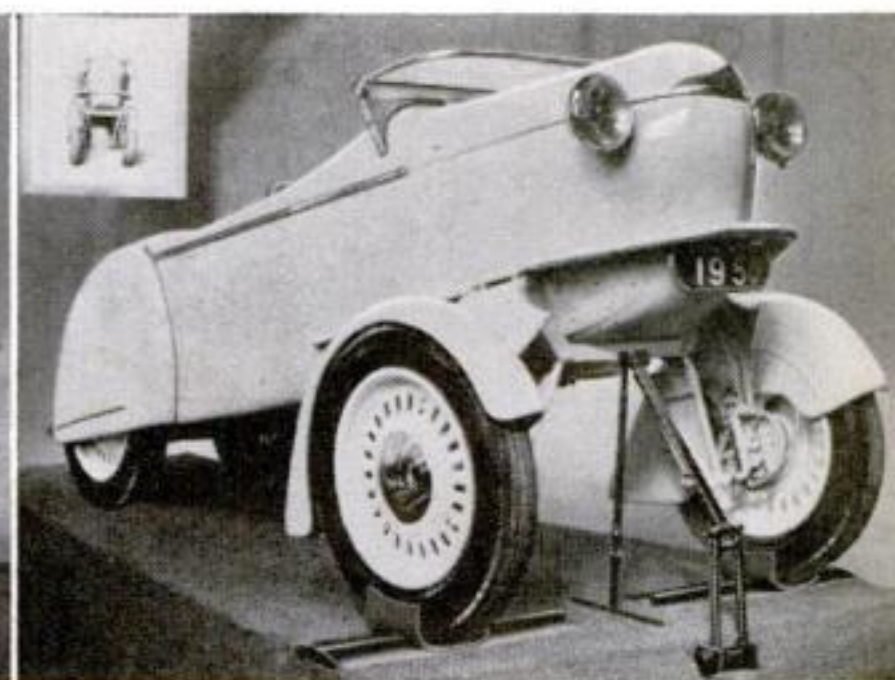
Each hull weighs 415 pounds, has a double bottom that forms a watertight buoyancy compartment and adds structural strength.



Nested hulls, with seats removed, stack neatly for transport by truck.



For parking, put jack under front end . . .



. . . lift, and wheels and fenders slide under.

### No parking problem here

Jack up the front of this French car, and its front wheels and fenders fold under—by pantograph action that keeps the wheels vertical—to the width of the narrow-track

rear wheels. They spread out again when you lift the fenders outward. The designer can roll his car into his Paris apartment house and park it in the entrance hall. The Rayonnah seats two in tandem, gets 60 m.p.h. from its rear-mounted engine.





# How to Seem Informed Without Really Trying

IT'S getting harder all the time to win friendly bets on such questions as what's the tallest or largest building, the biggest ship, or the longest bridge. Who doesn't know that these are the Empire State Building, Pentagon, Queen Elizabeth, and the Golden Gate Bridge?

Here are some offbeat superlatives, selected from the *Guinness Book of World Records*,\* that are almost guaranteed to keep you in free drinks for many argumentative evenings.

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## Fastest and Slowest

**Animal.** Over very short distances the fastest of land animals is the cheetah at 84 m.p.h. Average specimens weigh 100 lb. They are found chiefly in central India where they are trained for hunting. Tests in London in 1939 showed that on an oval track over 500 yards, the cheetah's average speed was 44 m.p.h. (a race horse does 41.2 m.p.h.).

**Fish.** The swordfish, which include marlins, are regarded as unrivaled for speed, though the practical difficulties of measurement make data extremely hard to get. A maximum of 50 knots (57.5 m.p.h.) has been calculated from an 18½-inch penetration of a bill into hard wood, but 30 to 35 knots is the most that will be conceded by some experts.

**Tree.** Discounting bamboo, which is not botanically a tree, the fastest-growing tree is the *eucalyptus saligna* of Uganda. A growth rate of 45 feet in two years has been measured.

**Train.** The world rail speed record is held jointly by two French Railway electric locomotives, the CC7107 and the BB9004. On March 29 and 30, 1955, hauling three carriages of a total weight of 100 tons, each achieved a speed of 205.6 m.p.h. The top speed was maintained for nearly 1¼ miles.

**Steam locomotive.** The world's speed record for steam locomotives is held by the British 4-6-2 Mallard. Hauling seven coaches weighing 240 tons gross, it hit 126 m.p.h. on July 3, 1938.

**Elevators.** The fastest passenger elevators in the world are those in the RCA Building, Rockefeller Plaza, New York. They rise a total of 795 feet at a speed of 1,400 feet per minute, or 15.9 miles per hour.

**Boats.** Highest speed ever achieved on water was 286 m.p.h. by Donald Campbell (Great Britain) on Sept. 19, 1956. He hit this in his first run, in the course of setting



a world's official water speed record of 225.63 m.p.h. in the turbojet-engined Bluebird K7, on Coniston Water, England.

The current record is 260.35 m.p.h., made on Lake Coniston on May 14, 1959.

**Hand sawing.** The world record for sawing through a 32-inch log is 1 minute 26.4 seconds by Paul M. Searls, 46, in Seattle, Wash., on Nov. 5, 1953.

**Land speed.** The fastest speed ever achieved on land is 632 m.p.h. by Lt. Col. John L. Stapp in an experimental rocket sled at the Holloman Air Base Development Center, Alamogordo, N.M., on March 19, 1954. In the 1½-second deceleration, Stapp survived a force of 22 Gs. The normal experimental limit is 12 Gs.

The fastest speed ever achieved by a wheeled vehicle is 404.60 m.p.h. by Mickey Thompson (U.S.), in his four-Pontiac-engined Challenger 1 on Bonneville Salt Flats, Utah, Sept. 9, 1960, in one direction.

**Tortoise.** Tests on a giant tortoise in Mauritius show that even when hungry and enticed by a cabbage, it cannot exceed five yards in a minute (0.17 m.p.h.). Over longer distances its speed is still slower.

**A snail's pace** varies from as slow as .000361 m.p.h., or 23 inches per hour, up to the .03125 m.p.h., or 55 yards per hour, of the common garden snail.



## Highest

**Wave.** The greatest possible height of a wave at sea is usually cited at 60 feet. However, the highest officially recorded sea wave was measured from USS Ramapo proceeding from Manila to San Diego on the night of Feb. 6-7, 1933, during a 68-knot (78.3 m.p.h.) gale. The wave was computed to be 112 feet from trough to crest.

The highest instrumentally measured wave was one 670 feet long and 60 feet high, by the Weather Explorer at 58°13'N. 16°30'W. on Nov. 28, 1956.

**Tides.** The greatest tides in the world are those in the Bay of Fundy, which separates Nova Scotia from the state of Maine and the Canadian province of New Brunswick. Burncoat Head in the Minas Basin,

Nova Scotia, has the largest mean spring range with 47.5 feet, and an extreme range of 53½ feet. The Canadian Tide Tables, however, have recently begun to list a maximum spring range of 54½ feet at Leaf Basin, Ungava Bay, in northern Canada.

**Kites** were used for meteorological purposes before balloons came into general use. At Mt. Weather, Va., on May 5, 1910, the U. S. Weather Bureau set an altitude record of 23,826 feet by flying 10 kites in tandem on a fine steel wire 8½ miles long.



## Longest

**Bird flight.** The record distance for any bird is 4,120 miles by a Laysan albatross, flying from the Philippines to Midway Atoll in the Pacific. Another homing bird released in Washington, D.C., in 1960, averaged 317 miles a day for 10 days against head winds.

**Railroad tunnel.** The world's longest main-line tunnel is the Simplon II, completed after four years' work in 1922. Linking Switzerland and Italy under the Alps, it is 12 miles, 1,677 feet long.

**Road tunnel.** The world's longest road tunnel is the Kanmon Tunnel, completed in 1958, which runs 6.01 miles from Honshu to Kyushu Island, Japan.

**Stairs.** The world's longest stairs are at the Aura power station, western Norway. Built of wood in 1952, these are 3,462 feet in length, rising in 3,715 steps at an angle of 45 degrees to a total height of 2,450 feet.

**Aqueduct.** The world's longest aqueduct is the Colorado River Aqueduct in southeastern California. The system, complete with conduit, tunnels, and syphons, is 242 miles long.

**The flight-duration record** is 64 days, 22 hours, 19 minutes, and 5 seconds, set by Robert Timm and John Cook in a Cessna 172. They took off from McCarran Airfield, Las Vegas, Nev., just before 3:53



p.m. on Feb. 7, 1959, and covered a distance equal to six times around the world.



## Largest and Smallest

**The largest submarine ever** built is the nuclear-powered USS Triton completed in August, 1959, at a cost of \$100 million. She has a submerged displacement of 8,000 tons, is 447 feet long, and has two reactors. Her range has been put at 100,000 miles.

**The largest rope** ever made was a coir-fiber launching rope 47 inches in diameter for the Great Eastern in 1858 by John and Edwin Wright. It consisted of four strands, each of 3,780 yarns.

**Dam.** The world's biggest concrete dam, and the biggest concrete structure in the world, is the Grand Coulee Dam on the Columbia River, Wash. Completed in 1942, it is 4,173 feet long and 550 feet high. It contains 10,585,000 cubic yards of concrete, and weighs about 21,600,000 tons. The hydroelectric power plant has a capacity of 1,249,800 kilowatts and is the largest of its type in the world.

**Hydrofoil boat.** The world's largest hydrofoil is the Sputnik, built in Gorky, USSR, with a capacity for 300 passengers and a top speed of 62 m.p.h.

**Automobile.** Of cars produced for private road use, the largest is the Bugatti Royale, type 41, known in Britain as the Golden Bugatti. Only six were made, and some still survive. First built in 1927, this machine had an 8-cylinder engine of 775 cu. in. capacity, and measured over 22 feet in length. The hood was over 7 feet long.

**Bulldozer.** The world's largest bulldozer is the 67-ton, 67-foot-long Le Tourneau Crash Pusher CP-1, driven on 6 tires 31 feet, 5 inches in circumference. The most powerful ground-clearer is the \$196,000, 125-ton Le Tourneau Electric Tree Crusher. It is 74 feet, 4 inches long, can clear 4 acres an hour.

**Helicopter.** The world's largest helicopter is the Soviet Mil Mi-6, which has a rotor diameter of about 115 feet and an esti-

mated weight of 31.7 tons. It has normal seating for 80 passengers and has set height records with loads up to 11.8 tons. It also holds the world speed record for helicopters, having achieved 167.2 m.p.h. over a 62-mile course on Nov. 21, 1959. On May 18, 1961, a speed of 192.9 m.p.h. was claimed for a Sikorsky HSS2.

**Sun furnace.** The largest solar furnace in the world is at Mont Louis in the eastern Pyrenees, France. Its parabolic reflector, 150 feet in diameter, is the largest mirror in the world and concentrates the sun's rays to provide 5,432 degrees F.

**The smallest tubing** in the world is made by Messrs. Accles and Pollock of Oldbury, Birmingham, England. It is of pure nickel with an outside diameter of 0.00073 inch and a bore of 0.0001 inch. It can be used for artificial insemination of queen bees.

**The smallest airplane** ever flown is the Stits Sky Baby, designed and built in the U.S. in 1952 by Ray Stits. It is a single-seat cabin biplane with a wing span of 7 feet, 2 inches; length of 9 feet, 2 inches; wing area of 36.5 square feet; and empty weight of 452 lbs. Powered by an 85-hp. Continental C85 racing engine, it has a top speed of 185 m.p.h. and lands at 60 m.p.h.

**The smallest watches** in the world are produced by Jaeger Le Coultre of Switzerland. Equipped with a 15-jeweled movement, they are just over half an inch long and three-sixteenths of an inch wide. They weigh under a quarter of an ounce.

**The smallest boat** ever to cross the Atlantic from west to east was the Sapolio—a canvas-covered folding boat, 14 feet, 6 inches long. W. A. Andrews left Atlantic City, N. J., in the Sapolio on July 2, 1892, and landed at Fuzetta, Portugal, 2,845 miles away—84 days later.



## Deepest

**Hole.** Man's deepest penetration into the earth's crust is the test-bore hole in Pecos County, Tex. On Oct. 12, 1958, the drilling crew reached 25,340 feet (4.8 miles) after 732 days. The cost was over \$3 million. The highest hole temperature was 351 degrees F.



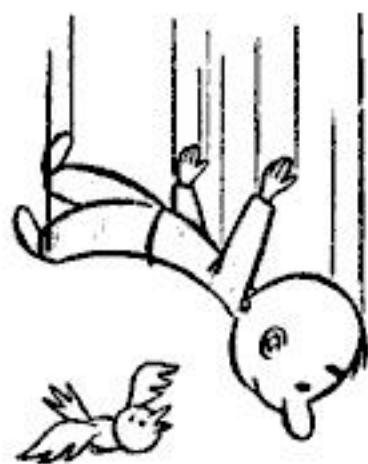
The 25,340-foot depth is sufficient to lower the Empire State Building down it 20 times over. The bore is, however, only three inches in diameter. The immense weight of drill pipe causes the metal to stretch as much as 20 feet.

**Mine.** The world's deepest mine is the East Rand Proprietary Mine in Boksburg, Transvaal, South Africa. On Aug. 8, 1958, the 11,000-foot mark below ground level was passed by three feet in a pilot winze (inclined passage) in the Hercules section.

**Pit.** The world's deepest open pit is the Kimberley Open Mine in South Africa, dug over a period of 43 years (1871 to 1914) to a depth of nearly 4,000 feet, a diameter of about 1,500 feet, and a circumference of nearly a mile. It covers an area of 38 acres. Three tons (14,504,566 carats) of diamonds have been extracted.

**Well.** The world's deepest water well is the Springleigh No. 3 artesian bore in Queensland, Australia. It's 7,009 feet deep.

**Anchorage.** The deepest anchorage ever achieved is 24,600 feet in the mid-Atlantic Romanche Trench with a 5½-mile-long nylon cable by Capt. Jacques-Yves Cousteau's research vessel Calypso, on July 29, 1956.



## Odds and Ends

**Lethal snakes.** Authorities differ on which snake possesses the most toxic venom. The venom of the tawny, dark-banded

Australian tiger snake (*Notechis scutatus*) is perhaps matched by that of the South American fer-de-lance. Two milligrams, or 1/14,000 ounce, of the tiger snake's venom will kill a man.

**Lonesome tree.** Reputedly the tree most remote from any other is one with roots extending down 100 feet in the Sahara oasis at Tenere. Though there is no other tree within 1,000 miles, it was rammed by a French lorry in 1960, and may now die.

**Biggest bang.** The greatest explosion in recorded history occurred Aug. 27, 1883, with the eruption of Krakatoa, an island

in the Sunda Strait in Indonesia. Rocks were hurled to a height of 34 miles, and dust fell 10 days later 3,313 miles away. The explosion was recorded four hours later on Rodriguez Island, 3,000 miles away, as the "roar of heavy guns." This explosion has been estimated to have had over a hundred times the power of the largest H-bomb test detonation.

**First auto.** The first successful gas-powered car was built by Carl Benz (1844-1929) of Wurttemberg and ran in Mannheim, Germany, in 1886. It was a three-wheeler reaching eight m.p.h.

**The cheapest car** of all time was the famous Ford Model T. In 1923 it sold for \$295.

**First jet.** The first flight by an airplane powered by a turbojet engine was made in Germany on Aug. 27, 1939, by the Heinkel He178, piloted by E. Warsitz.

**The highest sustained G-force** withstood was 31 Gs by a U. S. Navy volunteer in August, 1959. He was spun in a water-filled capsule on a centrifuge arm at over 3,000 m.p.h. for 12 seconds.

**Long fall.** The greatest altitude from which anyone has bailed out without a parachute and survived is 18,000 feet. This occurred on March 23, 1944, when Fl./Sgt. Nicholas Stephen Alkemade, 21, jumped from a blazing RAF Lancaster bomber over Germany. His headlong fall was broken by a fir tree and he landed in an 18-inch snow-bank—without a broken bone.

**Hottest.** Tungsten melts at 6,098 degrees F. It has to be heated to 10,652 degrees F. (4,554 degrees above its melting point) before it vaporizes.

The most refractory substances known are tantalum carbide and hafnium carbide, which melt at 7,124 degrees. The hottest flame attainable is an oxyzirconium flame at 7,200 degrees, which is over 1,500 degrees higher than oxyacetylene.

**Thinnest metal.** The most malleable, or ductile, of metals is gold. Either pure, or in an alloy containing 97 percent gold (the remainder being copper and silver), it can be beaten down without annealing from 1/1,000-inch thickness to about 1/250,000-inch thickness. One ounce of gold (avoir-du-pois) can be drawn out in a continuous wire thread to a length of 51 miles. ■ ■





# Umbrellas Are Back... for Picture Taking

By Jackson Hand

**I**N THE middle of the huge, dim armory a shapely, leotard-clad girl was doing backflips on a trampoline. A mysteriously blazing bright umbrella hung 20 feet overhead. Four smaller ones stood on poles at the corners of the platform.

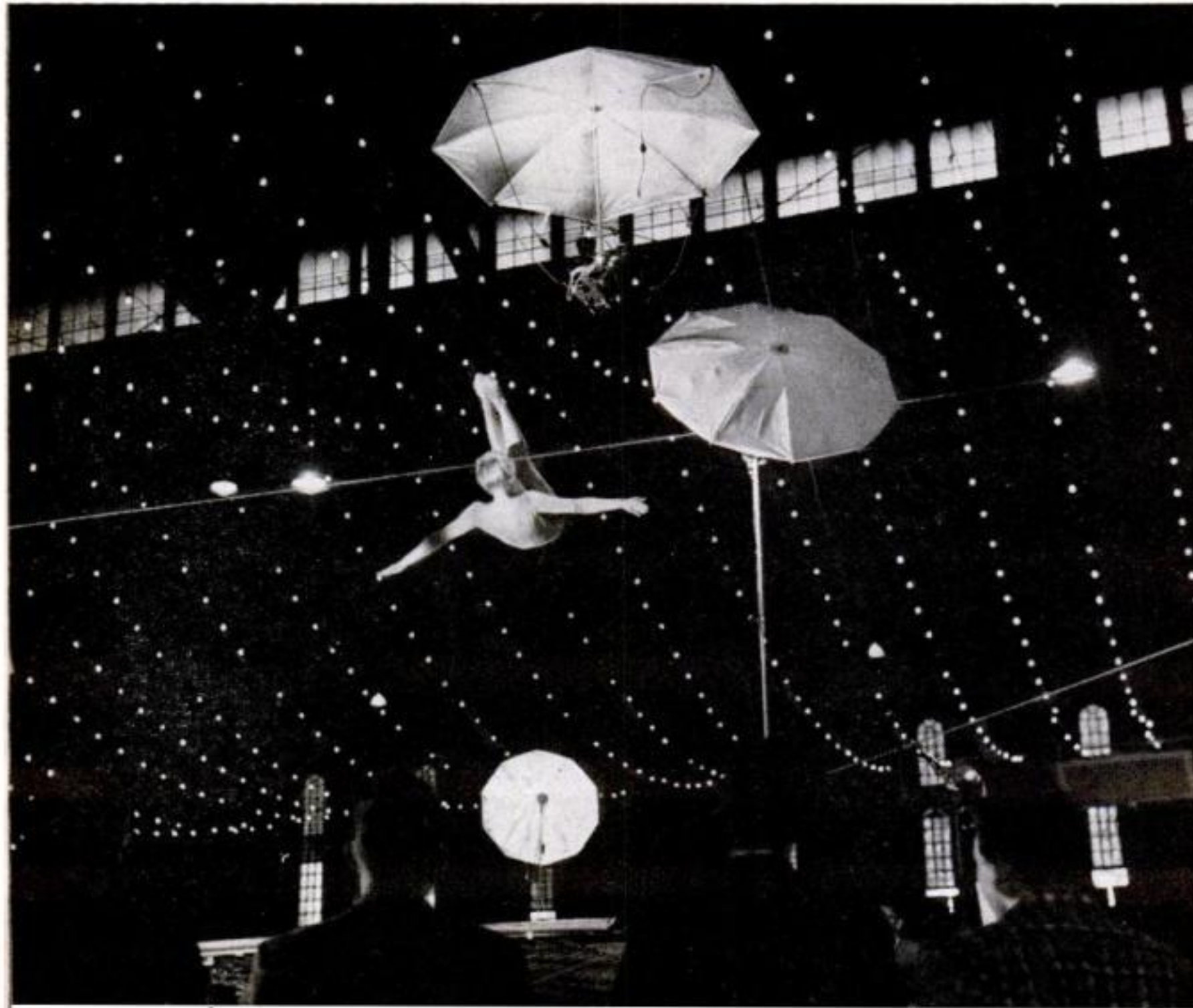
The girl's mission was to incite the hundreds of amateur photographers

millling about all four sides of the platform into using their cameras. They were being treated to their first experience with the photographic delights of umbrella lighting.

Amazingly, no matter how high she soared or where she landed, her figure was always bathed in brilliant but soft flattering light. From every angle pho-

Effectiveness of umbrella lighting was amply demonstrated at the annual Photo Fair in New

York. A pool of light enveloped the performer, permitting good snapshots from all angles.





### Amateurish portrait made with photofloods



Concentrated light sources ordinarily used by amateurs, photofloods or flash, are harsh and unflattering. Even if you have a model like this one, and read all the books, it takes much skill for even acceptable results. You get meaningless shadows, and when you try to erase them with another light you tend to multiply your troubles.



### Umbrella-light portrait has professional look



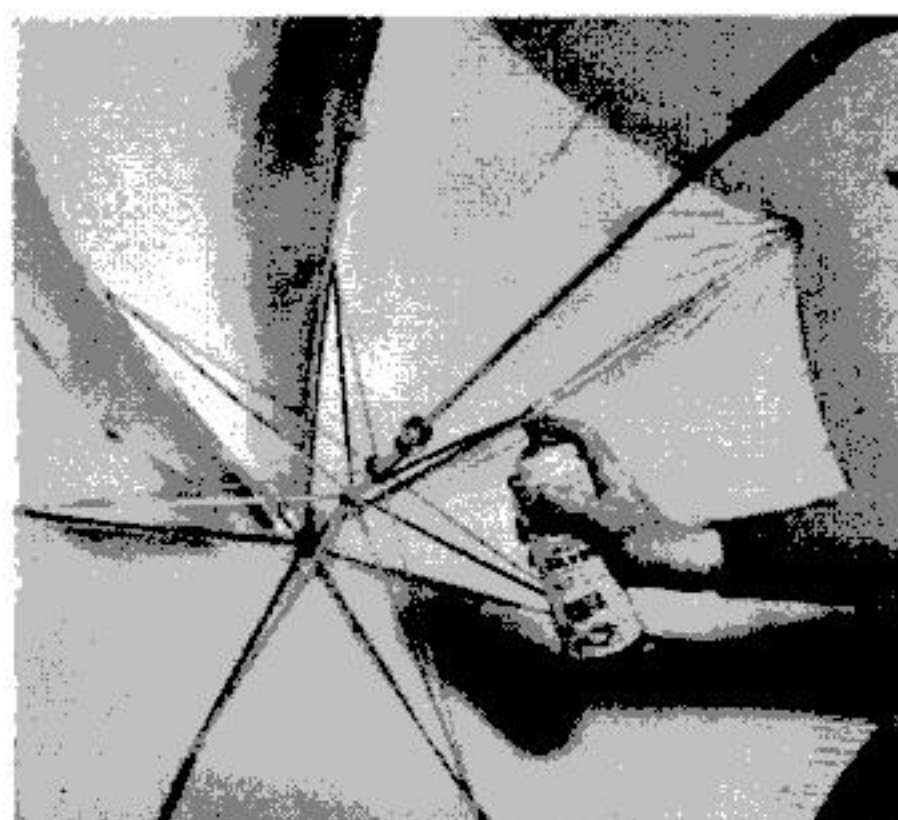
A broad source of light is the main difference between a professional-looking portrait and one that looks like a snapshot. You have much more leeway in posing, too. Exact placement of the light in relation to the head position is much less critical. Umbrella brings broad-source lighting within the amateur's reach.

CONTINUED

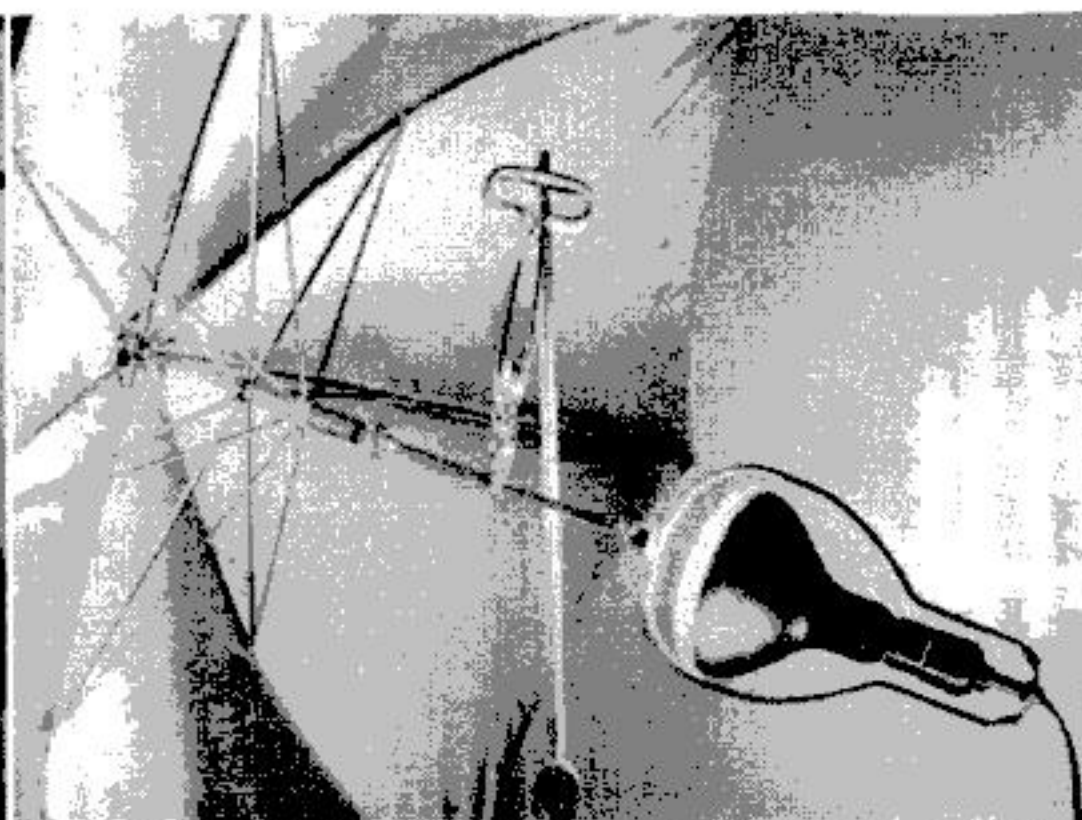




## How to make your own umbrella light



An umbrella, a can of spray paint, and a few parts from the hardware store are all you need to make your own umbrella light. Spray the



inside of the umbrella with aluminum paint and fit a lamp harp and socket to the cut-off umbrella handle. Use a reflector-flood light.

tographers were able to make perfect exposures at shutter speeds fast enough to stop the action—while getting better lighting than if they had had a battery of spots at their disposal.

The blazing umbrellas are a rebirth—in an up-to-date, commercial version—of a dodge used by many professional photographers ever since Edison saddled them with the problem of making pictures by artificial light. Now you can use it to brighten your prospects of producing pleasing portraits.

Few challenges to his skills wind up as disastrously for the average amateur as attempts to “shoot” his friends, wife, or sweetheart. Light from the concentrated sources ordinarily used—photo-floods and flash—is harsh, casts hard shadows, and is generally unforgiving of anything less than perfection in the subject of photographic technique.

One way the old pros licked the problem was by bouncing light off a reflecting surface to get a broad, spread-out source. Some minor genius stumbled onto the umbrella idea for a reflector and it worked so well that photographers have been cobbling together their own variations of the idea ever since.

Recently, a young (32) virtuoso-of-

the-lamp named Jerry Johnson combined some new technology with the old idea and came up with a product that is exciting photographers from Hollywood to the Congo. His busy, more-or-less-one-man firm (Photo Lectronics Research Company, 141 W. 42nd St., NYC) is having a hard time keeping up with the demand. Although he has been supplying his professional customers for some time, the dramatic demonstration at the Annual Photo Fair in New York, described above, is the first attempt to woo the amateur.

Prices for the umbrella (Reflectal) start at \$36.50 for the 32-inch size. Complete systems (christened Northlight) come with stand and choice of light sources; the cheapest is \$69.50.

Northlights use a small, high-intensity bulb such as the sealed-beam GE 650-watt DXK, the RFL2 500-watt reflector flood, or Sylvania's new 550-watt reflector flood. For the big six-foot professional umbrellas, four modified DXKs are clustered around the stem.

The reflectivity of the Reflectal surface is about 85 percent. The percentage of useful light is high. For example, load your camera with Tri-X or Hypan

*(Continued on page 182)*



# "I'd like to see them make..."

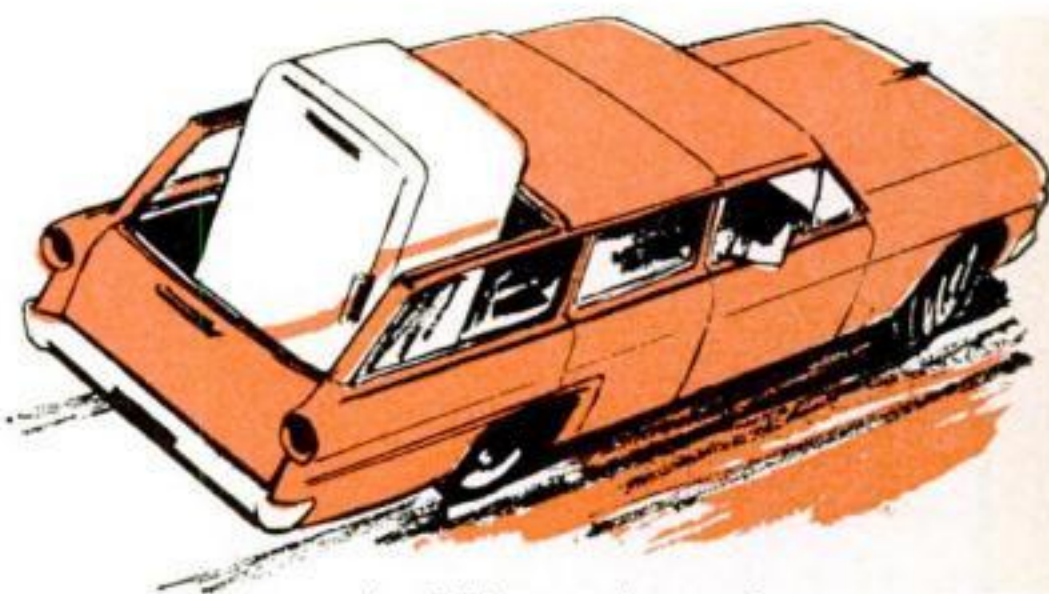
A canoe outrigger of foam plastic with flexible fiber-glass boom supports. It would stabilize a canoe and be light in weight for easy transporting to water.—Peter Mundy, Libertyville, Ill.



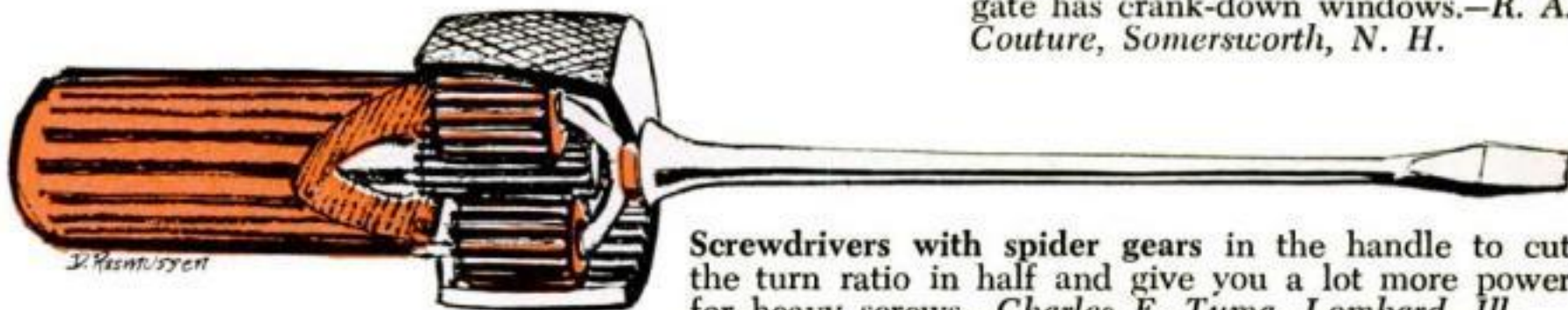
Dog - feeding dishes, weighted at bottom and with a collar at top to anchor aluminum foil. No dishwashing; just throw away the liner.—E. Bloomingdale, Lindenhurst, N.Y.



A lift-up handle at the front of power mowers. This would make it safer and easier to lift a mower into a car trunk or carry it down cellar stairs.—Allen Kast, Tell City, Ind.



A sliding roof panel on wagons to admit tall cargo. Cost of the change shouldn't be too great where the tailgate has crank-down windows.—R. A. Couture, Somersworth, N. H.

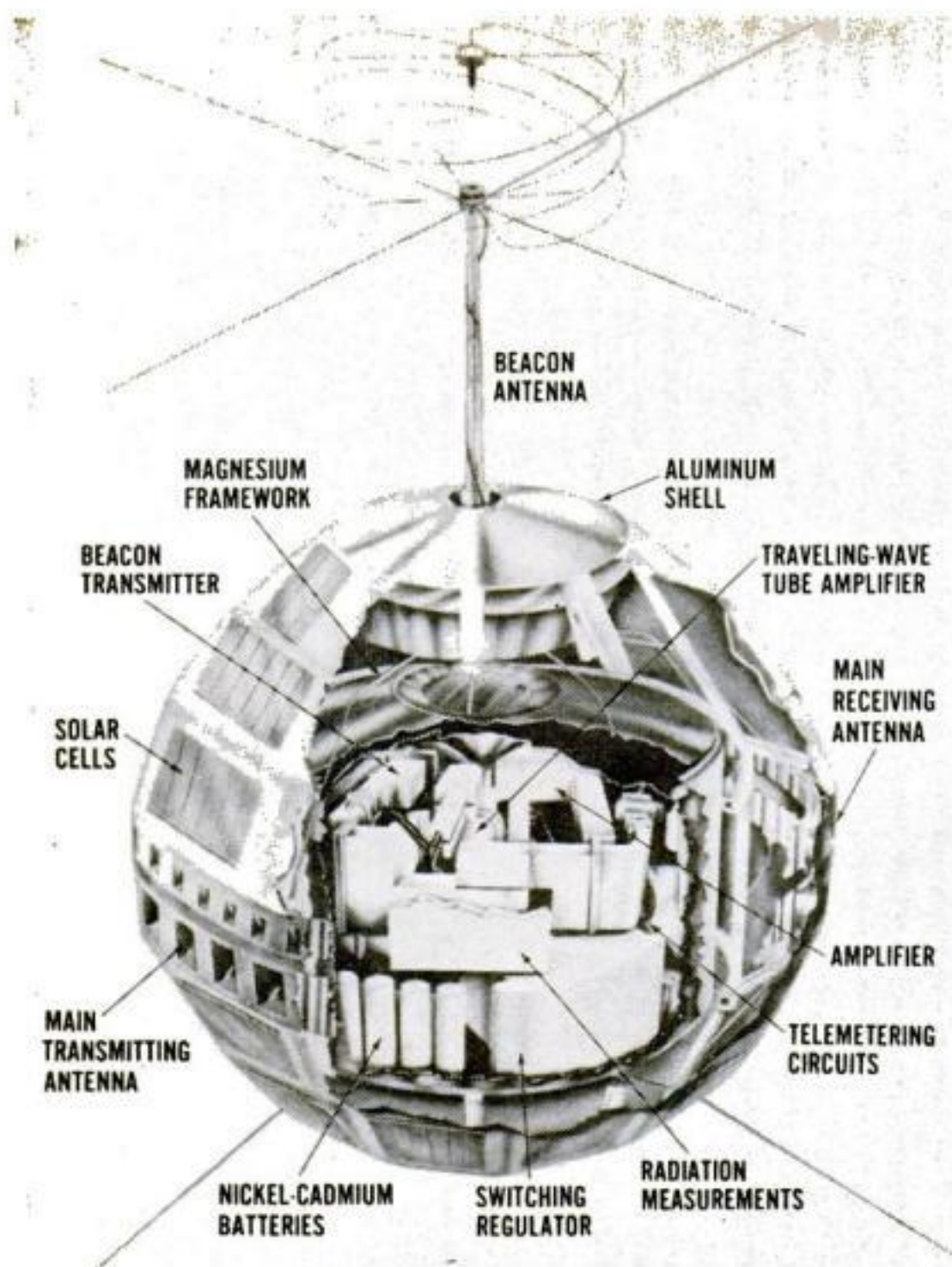


Screwdrivers with spider gears in the handle to cut the turn ratio in half and give you a lot more power for heavy screws.—Charles E. Tuma, Lombard, Ill.

Everyone has his own pet idea of a gadget that he would like to see in general use. What's yours? We will pay \$5 for each one published. Please use Government postcards

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Now you'll see Europe  
—live—as a metal ball  
bounces TV around  
the earth's curve

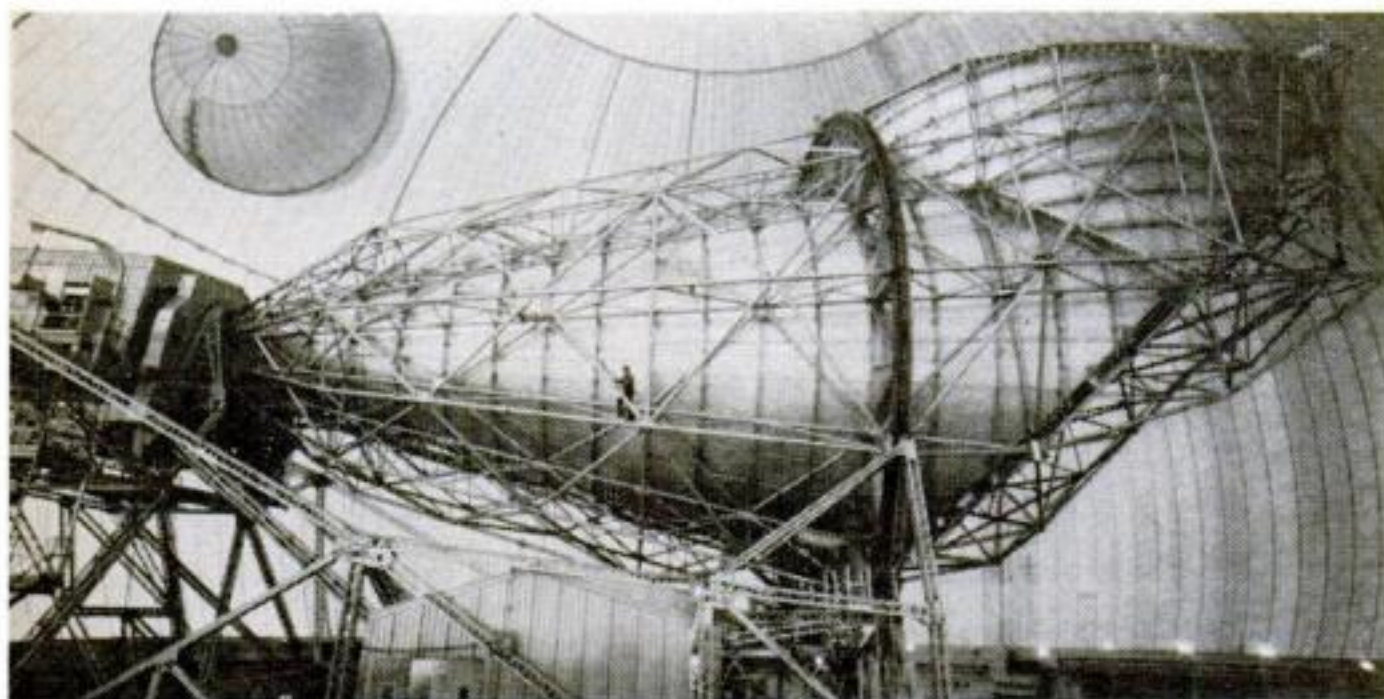
Relay satellite circles earth  
once every three hours,  
at altitudes from  
500 to 3,000 miles



Satellite receives microwave  
beam, amplifies it, retransmits  
it to U.S. ground station

Orbiting relay station is  
packed solid with 1,064  
transistors, 1,464 diodes,  
and a single vacuum  
tube—a powerful travel-  
ing-wave amplifier. Its  
nickel batteries are re-  
charged by solar cells  
that convert sunlight di-  
rectly into electricity.

# Satellite to Put Europe on TV



U.S. ground station is world's biggest horn antenna inside world's biggest inflated shelter—a 210-foot Dacron-rubber balloon. It must track the satellite with 1/20-degree accuracy. Antenna turns on 70-foot wheel machined true within 1/32 inch. It receives and retransmits microwave beam, linking satellite to regular network that interconnects TV stations.

U.S. station  
ANDOVER, ME.





**T**HIS month space satellites are supposed to take off their lab-research white coats and roll up their sleeves for bread-and-butter work. The first job is a glamorous one that everybody can enjoy: the long-promised direct look, via television, at European sights.

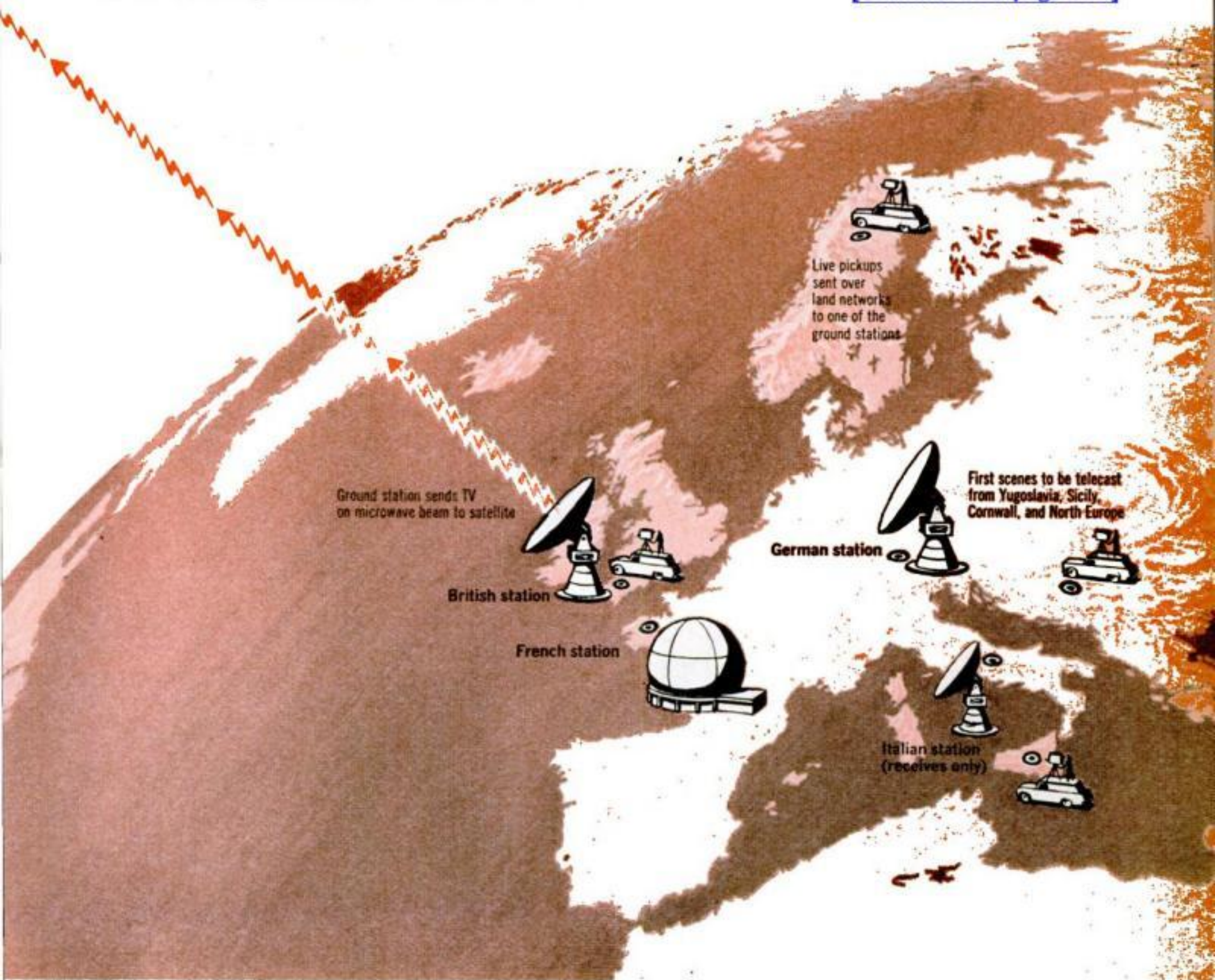
The working satellite is Telstar—a three-foot magnesium ball that is faceted with 3,600 solar electric cells on the outside. Inside it's filled with complex receiving and transmitting gear cushioned in pink foam. It will relay TV signals between ground stations in Europe and the U.S. For the first time in history, you will be able to see what is happening on another continent at the very instant it happens. (Well, almost—there will be an eyeblink delay, less than 1/30 second, because of the time the

signals take traveling to and from the Telstar satellite.)

The first satellite TV show, for home consumption only, will bounce live pickups from the main ground station at Andover, Me., via Telstar to a smaller station at Holmdel, N.J. A few weeks later the transatlantic programs—direct views of scenic points in Europe and America—will follow. Because of the time-zone difference, Americans will get their first live-TV view of Europe in midday, around 2 p.m. Eastern time.

Only a satellite can do this transatlantic job. Television shows are sent between cities on beams of microwaves, which travel in straight lines like light beams. To get around the curvature of the earth, they must be received and re-

*[Continued on page 183]*





**EXCLUSIVE!**



A 58-day-old human embryo,  $1\frac{1}{5}$  inches long. Visible are eye, spine, and arm bud (white spot).



# Now We're Growing Human Life in the Laboratory

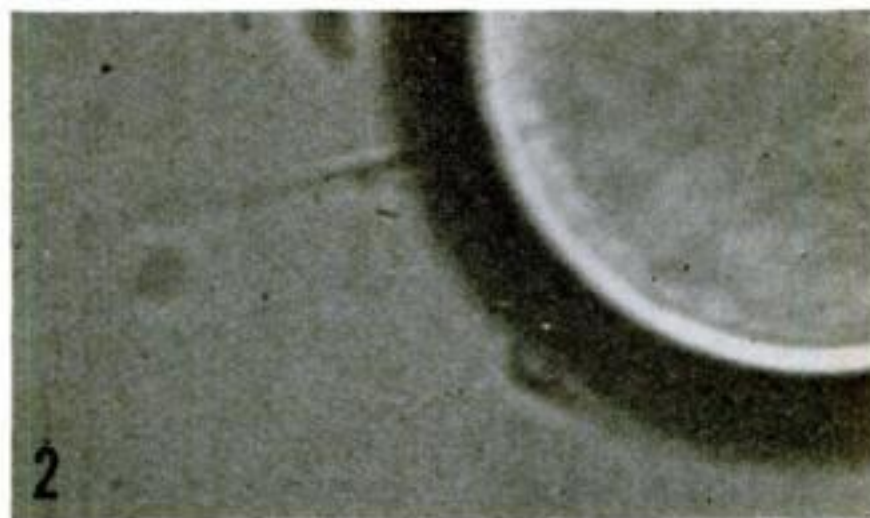
In an extraordinary series of experiments, Dr. Daniele Petrucci, an Italian surgeon, has produced human embryos outside the womb—"not to create life, but to preserve it"

By Joan Steen

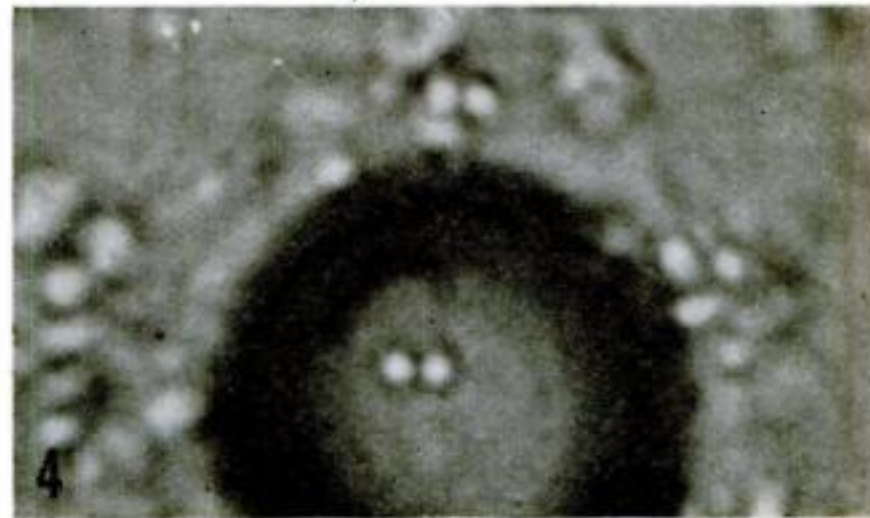
**Y**OU have never seen a photo like the enlargement at left. It shows a human embryo 58 days old. Development of the embryo was normal in every way but one: From the moment the egg was fertilized to the time this picture was taken, it had been growing in a plastic jar on a laboratory shelf.

The extraordinary experiment was the 42nd attempt by an Italian scientist to grow a human embryo outside the womb. "Not to create life," Dr. Daniele Petrucci told me in his small office in downtown Bologna, "but to preserve it." The 40-year-old surgeon is using this startling technique to solve one of the world's knottiest medical problems: how to transplant human tissue. Doctors

**Life begins when the sperm head joins the egg nucleus**



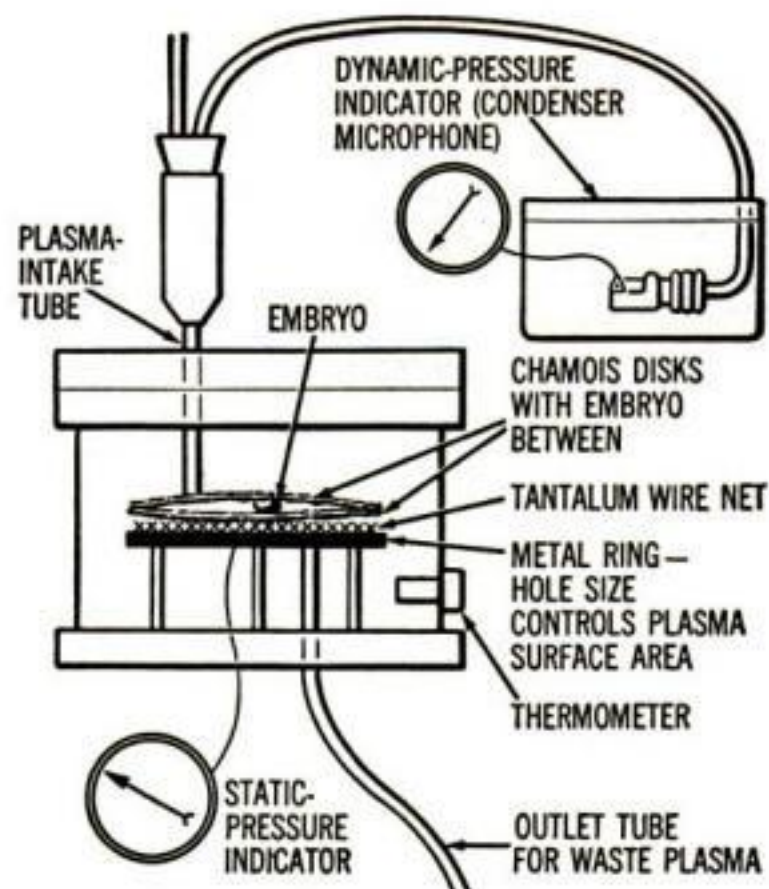
Moving its tail vigorously, a sperm breaks through the egg membrane. Once inside, its head



grows larger, it discards its tail, and at moment of fertilization seems a twin of egg nucleus.

CONTINUED





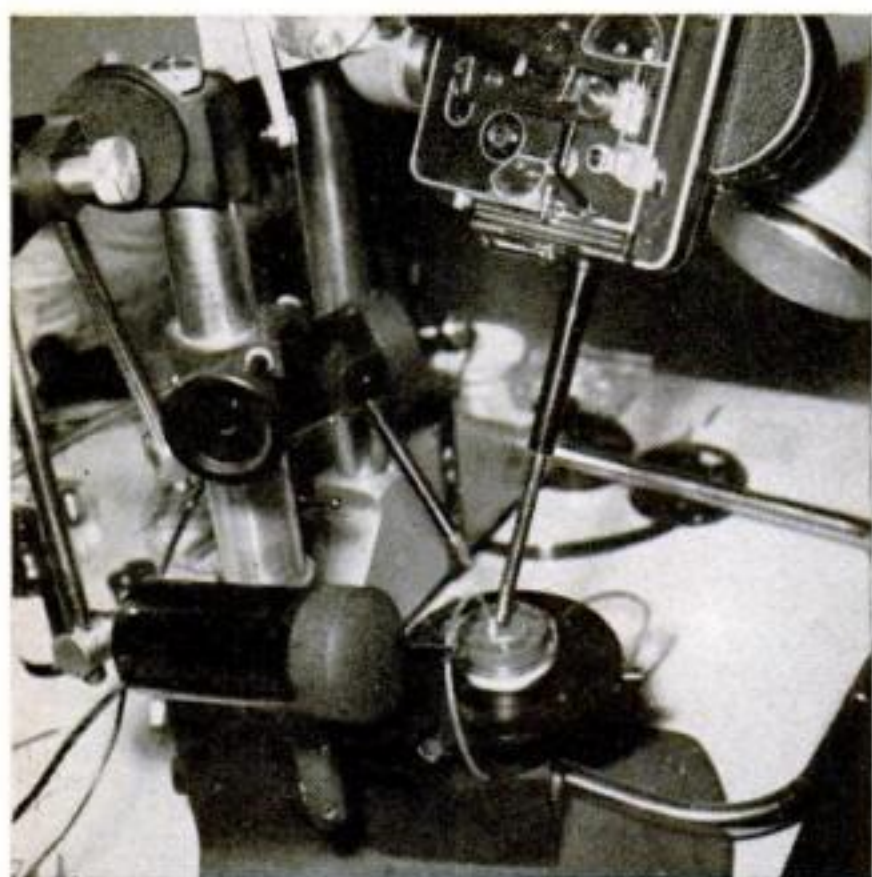
Embryo grows between chamois disks in "biological cradle." The disks (top one visible in photo) soak up plasma dripped in at arterial rate, drained at venous rate. During experiments, cradle sits in body-temperature water.

could save the lives of thousands of patients with defective lungs, kidneys—even hearts—if they could only replace sick parts with healthy ones.

But the difficulty—quite apart from the delicate surgery involved—is that practically none of these major transplants will "take" for more than a few hours. The situation is like a blood

transfusion, which is a disaster unless donor and patient have the same blood type. Only worse: Until now, major transplants haven't worked unless they've been between identical twins. "Foreign" tissue contains substances—antigens—that trigger the body to fight the transplant in the same way it tries to shake off a

[\[Continued on page 186\]](#)



Camera photographs embryo through transparent walls of small cradle used for two-week experiments. Dr. Petrucci used both infrared and phase-contrast photography techniques.



Dr. Petrucci holds photo of Siamese twins he saw in Russia last fall. He had been invited to discuss his work with Soviet embryologists. With him is his assistant, Dr. Laura di Pauli.





### Tiny radar is held like a submachine gun

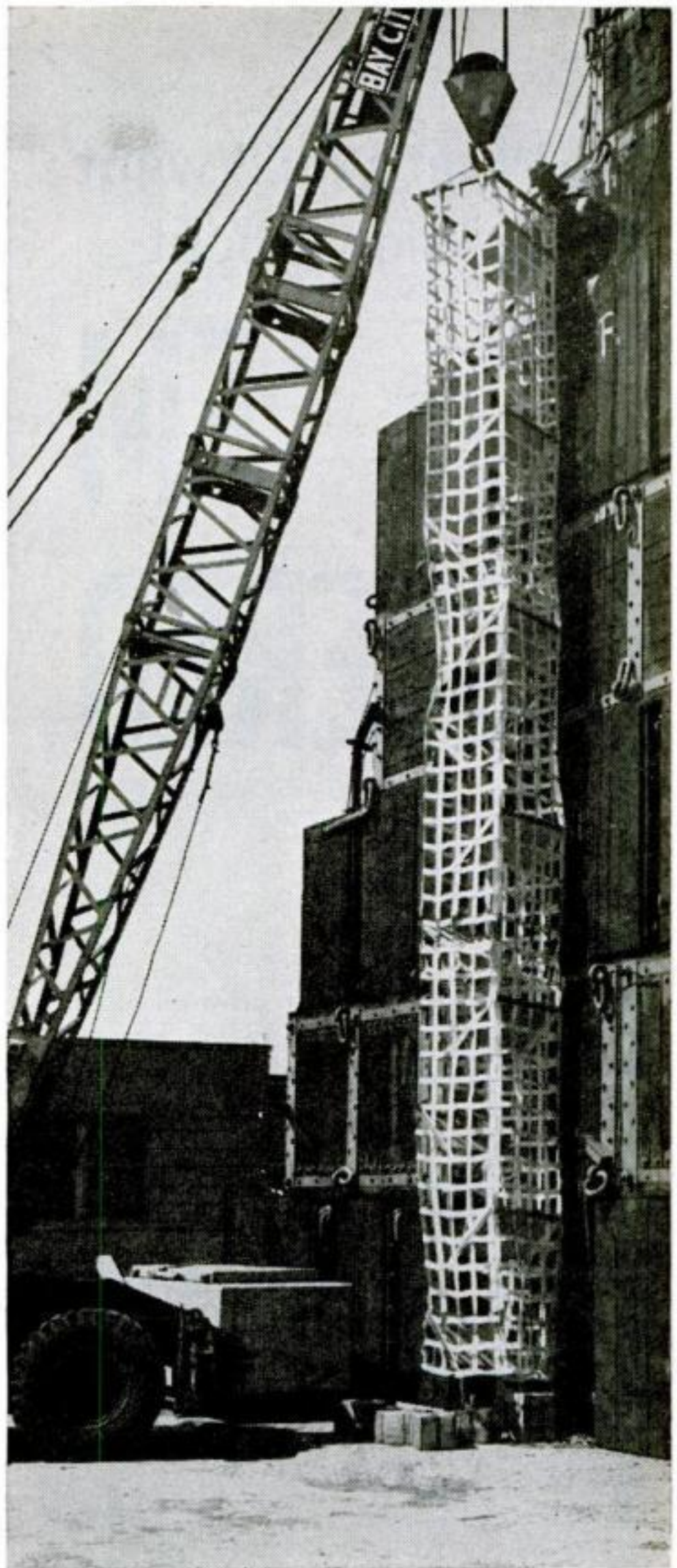
A miniature radar that weighs only 10 pounds has been developed by the Army Signal Corps at Fort Monmouth, N.J. It's fitted with a pistol grip that lets a soldier aim it like a submachine gun.

The radar picks out moving objects, producing different signals for tanks, jeeps, and soldiers on foot; and penetrates fog, darkness, and light foliage. A belt-worn battery powers it for 12 hours.



### Japanese phone booth

Public telephones on sidewalks in Tokyo occupy minimum space. Glass-enclosed booths mounted on light posts cover only the instrument, not the user, who stands on the outside. They're fine in fair weather, tough when it rains.



### Vertical chute eases cargo landing

A series of plywood baffles inside a nylon net will enable the Navy to unload cargo vertically from the side of a ship. Each baffle momentarily breaks the fall of cartons, crates, and bags to provide a gentle landing. The chute shown in a tryout at Bayonne, N.J., is held upright here by a crane.



What you'll want  
to know about

# FM STEREO

By C. P. Gilmore

**B**Y THE time you read this, FM multiplex—the system of broadcasting that enables you to receive stereo programs on a single FM radio—will be one year old. Nothing since the introduction of stereo records has caused such spontaneous enthusiasm among the listening public. Despite growing pains, the verdict is in—it's a hit:

- Dealers can't get enough sets to meet the demand. When KPEN in San Francisco went stereo last August, the entire stock of receivers vanished like snowflakes in a hot skillet.

- WHDA in Dover, N. J., had to run ads in the local paper asking eager listeners to be patient. Dealers were sold out and callers swamped the station switchboard wanting to know where to buy stereo receivers.

- Manufacturers, naturally, are ecstatic. Said one sales manager, "It's the biggest thing since television."

- Already, some 150 to 200 stations

## How Multiplexing

**M**ULTIPLEXING is an electronic trick that crams two separate signals into the radio wave normally transmitted by an FM station. In FM stereo broadcasting, one of these is the main signal that you hear on an ordinary FM receiver; the other carries stereo information that you can use only if you have a stereo adapter.

Suppose a piano and clarinet are playing. Microphone A is close to the piano; B is near the clarinet. The left channel signal (A) will be dominated by the piano tones, with the clarinet in the background, and vice versa for the right channel signal (B). In multiplex broadcasting, these two signals are sent separately to a sort of electronic adding machine called a matrix. The matrix combines A and B in two different ways to produce two new signals: one the electrical equivalent of  $A+B$ ; the other,  $A-B$ .

It's easy enough to imagine  $A+B$ —it's what you'd hear if you put your ear to a hole in the studio wall halfway between the two instruments. But  $A-B$  is strictly electronic sleight-of-hand—it doesn't exist outside the wonderland of electronics and algebra.

$A+B$  goes directly from the matrix to the FM transmitter. It's what you hear on an ordinary FM receiver. But  $A-B$ , before it is sent to the transmitter, gets mixed with a 38-kc. tone called a subcarrier. This is the dodge that keeps the two channels from getting scrambled together while riding the same radio wave.

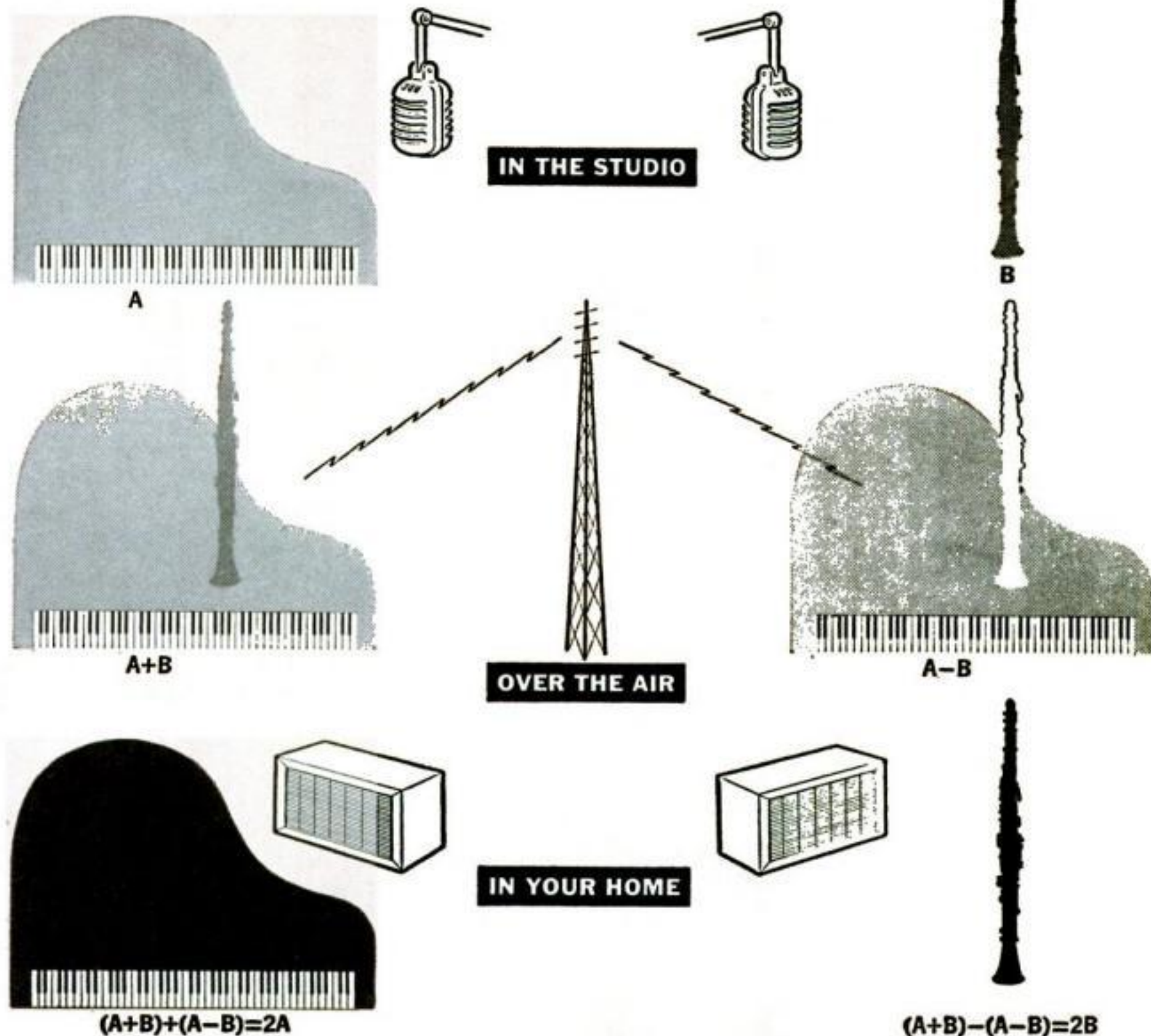
**Sorting the signals.** Now your stereo receiver goes to work. It must sort out the signals and reconstruct the information for the left- and right-channel speakers.

A stereo adapter is something like a fruit sorter. It has a series of electronic "holes" through which signals of the right "size" fall. One of these holes—engineers call them gates—lets the  $A+B$  signal through. Another sorts out the  $A-B$ , tagged with its 38-kc. identifying tag.

Once the  $A-B$  signal slips through its gate, the 38-kc. signal, which was there only to guide it through the right gate, is no longer needed. A special circuit strips it away, leaving the  $A-B$  signal just as it was originally created in the transmitter. Now  $A+B$  and  $A-B$  are sent to another matrix. Here, in one part of the matrix,



# Brings FM Stereo into Your Home



$A-B$  is added to  $A+B$ ; in another part, at the same time, it is subtracted. Like this:

$$\begin{array}{r} (A+B) \\ + (A-B) \\ \hline 2A \end{array} \quad \begin{array}{r} (A+B) \\ - (A-B) \\ \hline 2B \end{array}$$

The resulting  $2A$  and  $2B$  are the same as  $A$  and  $B$ , but twice as big. Now separated once again,  $A$  and  $B$  are sent on to individual amplifiers and speakers.

**Why all the  $A+B$  and  $A-B$  fuss?** Why not simply send the piano ( $A$ ) through on the main channel and tag the clarinet ( $B$ ) with the 38-kc. signal? If every listener to a stereo broadcast had a multiplex receiver, this would be fine. But not everyone has stereo. The listener with mono would receive mainly  $A$ , the piano. He'd hear only one side of the stereo broadcast.

With  $A$  and  $B$  mixed on the main channel, the mono listener hears a perfectly blended monophonic signal, composed of both  $A$  and  $B$ . At the same time, through matrixing, the multiplex listener separates the left and right signals and hears true stereo with sounds that originated on the left coming from his left; those on the right from his right.

Most stereo adapters use circuits of the matrixing type, although other ways of decoding the multiplex signal are gaining favor. Essentially, the 38-kc. signal described earlier can be viewed as switching the transmitter between the two channels 38,000 times a second. The adapter simply turns on the left channel when the transmitter is sending that signal and switches to the right channel when the transmitter does. Circuits using this system are called switching or enveloping detectors.



have switched to stereo. Factories making broadcast equipment are working at top speed, can't keep up with the orders.

**The stampede to stereo.** About four years ago when the perfected stereo phonograph record hit the market, music lovers were bowled over by the startling realism of sound reproduced through two independent channels. The roundness and depth of tones, blended from two speakers, swelled even a tiny living room to the size of a concert hall. With monophonic (ordinary, single channel) hi-fi, the best impression you could hope for was that of live music heard through an open window; with stereo, the musicians moved into the room. Listeners from Bangor to L.A. eagerly converted record players to stereo. Many who had been casual listeners became attentive concert-goers-at-home.

But home record libraries are limited and when fans switched to broadcast music for variety, they had to settle for single-channel monophonic sound. By contrast, it sounded dull and lifeless.

**AM-FM stereo.** A few metropolitan stations with both AM and FM transmitters tried one solution. They broadcast one stereo channel on AM, the

other on FM. You tuned in both the AM and the FM to get stereo.

The system worked, but there were a couple of drawbacks: 1) If you weren't equipped for stereo, you heard only one channel—the music sounded unbalanced. 2) Even if you received both channels, the stereo effect wasn't very good. The AM channel couldn't deliver the fidelity of FM—the signals didn't match well enough for good stereo.

The Federal Communications Commission was flooded with requests to do something about broadcast stereo. Knowledgeable hi-fi fans knew it was technically possible to solve the problem by a bit of electronic trickery called multiplex. They wrote to the FCC demanding that multiplex stereo, with appropriate standards, be authorized.

There are many ways of cramming two audio signals into a single radio wave without the two becoming scrambled. Each system had its backer in the electronics industry. To pick the best, the FCC asked an industry group to conduct tests and submit results. After studying the data, the FCC picked a combination of the systems proposed by GE and Zenith, and announced that multiplexing could start on June 1, 1961.

## FM Stations Now Broadcasting Stereophonically

<b>ALABAMA</b>	
Birmingham .....	WCRT-FM
<b>ARIZONA</b>	
Phoenix .....	KEPI, KNIX
<b>CALIFORNIA</b>	
Fresno .....	KCIB, KXQR
Los Angeles .....	KFMU, KMLA
Sacramento .....	KSFM
San Diego .....	KGB-FM, KLRO, KPRI
San Francisco .....	KBAY-FM, KPEN
San Jose .....	KSJO-FM
Santa Barbara .....	KMUZ
Visalia .....	KONG-FM
<b>DELAWARE</b>	
Wilmington .....	WJBR
<b>DISTRICT OF COLUMBIA</b>	
Washington (Bethesda, Md.)	WHFS
<b>FLORIDA</b>	
Miami .....	WAEZ, WVCG-FM
Orlando .....	WHOO-FM
<b>ILLINOIS</b>	
Chicago .....	WFMT, WEFM, WKFM
Rock Island .....	WHBF-FM
<b>INDIANA</b>	
Indianapolis .....	WISH-FM
<b>IOWA</b>	
Des Moines .....	KDMI

<b>KANSAS</b>	
Lawrence .....	KANU
<b>MARYLAND</b>	
Baltimore .....	WAQE-FM
<b>MASSACHUSETTS</b>	
Lynn (inactive) .....	WUPY
Waltham .....	WCRB-FM
<b>MICHIGAN</b>	
Detroit	WDTM, WGPR-FM, WLDM
East Lansing .....	WSMW
Grand Rapids .....	WJEF-FM, WOOD-FM
<b>MINNESOTA</b>	
Minneapolis .....	KWFM, WAYL
<b>MISSOURI</b>	
Kansas City .....	KCMO-FM
St. Louis .....	KCFM, KSHE
<b>NEBRASKA</b>	
Omaha .....	KQAL-FM
<b>NEW JERSEY</b>	
Dover .....	WDHA-FM
Long Branch .....	WRLB
<b>NEW YORK</b>	
Garden City .....	WLIR
New York .....	WQXR-FM, WTFM
Schenectady .....	WGFM
Syracuse .....	WSYR-FM
<b>NORTH CAROLINA</b>	
Burlington .....	WBBB-FM

<b>OHIO</b>	
Akron-Barberton .....	WDBN
Cleveland .....	WNOB
Columbus .....	WBNS-FM
Middletown .....	WPFB
<b>OREGON</b>	
Eugene .....	KFMY
Portland .....	KPFM
<b>PENNSYLVANIA</b>	
Johnstown .....	WJAC-FM
Norristown .....	WIFI
Philadelphia .....	WFLN-FM
Pittsburgh .....	WKJF
Wilkes-Barre .....	WYZZ
<b>RHODE ISLAND</b>	
Providence .....	WPFM
<b>SOUTH CAROLINA</b>	
Spartanburg .....	WSPA-FM
<b>TEXAS</b>	
Dallas .....	KIXL-FM
Houston .....	KFMK, KODA-FM
<b>WASHINGTON</b>	
Seattle .....	KISW, KLSN
<b>WISCONSIN</b>	
Milwaukee .....	WMKE, WTMJ-FM
<b>CANADA</b>	
Toronto .....	CFRB-FM, CHFI-FM



The system authorized, by a clever bit of electronic algebra, gives a full-fidelity signal on a standard FM radio while also delivering two signals of equal fidelity to those listeners with stereo receivers.

**Can you convert?** Your present FM radio may be easily converted for stereo—or it may be next to worthless. If it is a table model AC-DC job, forget it. The same goes for almost any “package” job—the furniture-type consoles with everything in one box. (There is a device on the market that will give you some stereo effect when used with an ordinary FM radio. It’s called a multiplexer. It will receive either the right or left channel of a stereo broadcast. You can use it for one source of sound and your FM radio for the other. The result is not *true* stereo, but you do hear a pseudostereo effect.)

If you’ve got a component hi-fi—a rig made up of separate amplifiers, speakers, turntable, and FM tuner—then you’ve got something to work with. If your setup is monophonic, you’ll have to add an extra amplifier and speaker. But let’s assume you’re equipped for stereo records.

Next question: Does your tuner have

a jack on the back labeled “MX” (for multiplex)? Chances are, a tuner with no MX jack is fairly old. In many of the older sets, the electronic channel through which the FM signal has to pass isn’t wide enough for the entire MX signal to squeeze through. Engineers say the band pass isn’t wide enough.

Find out from the manufacturer if the set can be converted, and if so, how. If you’ve got an FM expert in the neighborhood—you may find one at a shop specializing in hi-fi—ask his opinion. But be sure he’s an expert: This is no job for the average corner TV repairman.

If your tuner has an MX jack, you’re in. The manufacturer probably puts out a brochure recommending a certain adapter. He’s got two reasons for pushing his own make: 1) he wants to sell you one; 2) you might get in trouble using another kind. Your tuner may have low output, for example. Team it with an insensitive adapter, and it just won’t go.

**The band-pass problem.** This crops up again here: A wide-band tuner has a wide enough channel for all of the MX signal to get through easily. With one of these (and this includes most

[\[Continued on page 184\]](#)

## Stations Preparing for FM Stereo

CALIFORNIA	
Los Angeles	KBMS, KGCK
Oceanside	KUDE-FM
San Francisco	KBCO
Walnut Creek	KWME
Woodland	KATT
COLORADO	
Denver	KFML-FM
Manitou Springs	KCMS-FM
CONNECTICUT	
Meriden	WBMI
Newton	WGHF
DISTRICT OF COLUMBIA	
Washington	WASH
FLORIDA	
Gainesville	WRUF-FM
Sarasota	WYAK
GEORGIA	
Columbus	WRBL-FM
ILLINOIS	
Chicago	WSBC-TV
INDIANA	
Evansville	WIKY-FM
KANSAS	
Wichita	KCMB-FM

KENTUCKY	
Lexington	WVLK-FM
Louisville	WLVL
MAINE	
Caribou	WFST-FM
MICHIGAN	
Detroit	WOMC
Midland	WQDC
MISSOURI	
St. Louis	KWIX
NEVADA	
Las Vegas	KORK-FM
NEW YORK	
Babylon	WOMF
Buffalo	WYSL-FM
NORTH CAROLINA	
Greensboro	WMDE
OHIO	
Cincinnati	WAEF-FM
Cleveland	WDGO
Toledo	WTOL-FM
OREGON	
Portland	KGMG

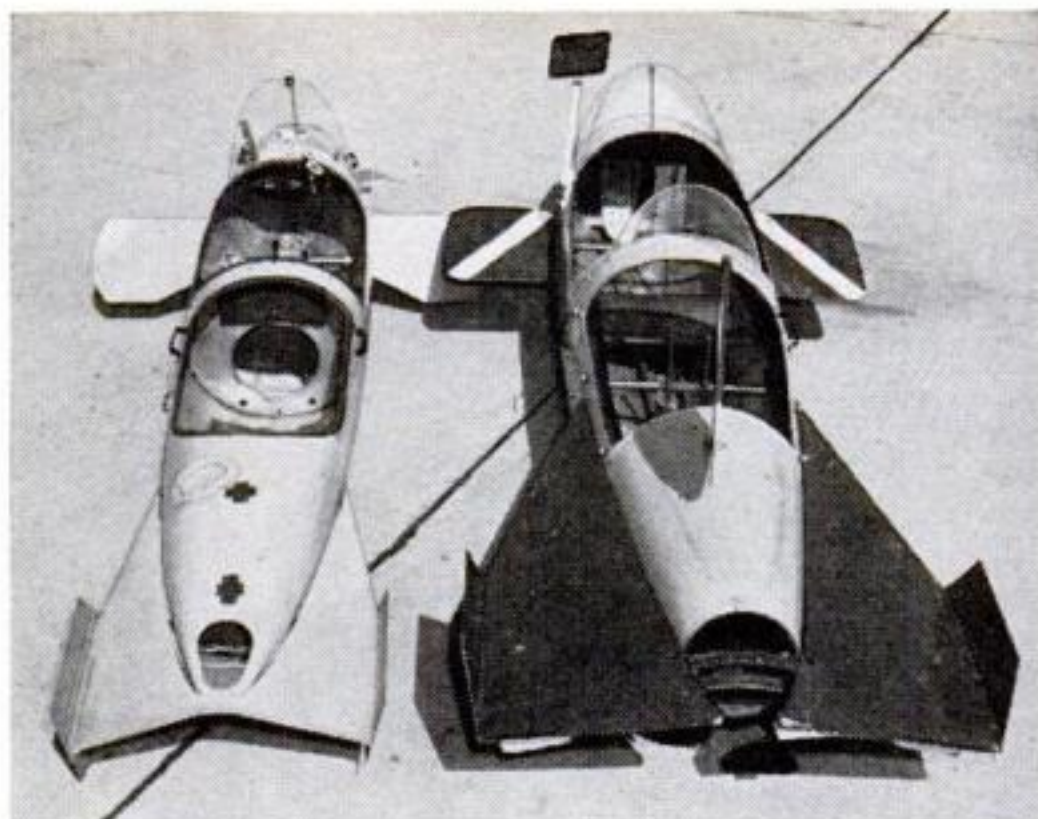
PENNSYLVANIA	
Philadelphia	WHAT-FM, WOAL
Pittsburgh	WLOA-FM
	WWSW-FM
Warren	WRRN
SOUTH CAROLINA	
Seneca	WSNW-FM
TENNESSEE	
Nashville	WNFO-FM
TEXAS	
Austin	KTBC-FM
Dallas	KRLD-FM, KSFM
Houston	KQUE, KRBE
Midland	KNFM
Port Arthur	KFMP
Wichita Falls	KNTD
VIRGINIA	
Richmond	WFMV
Roanoke	WSLS-FM
WASHINGTON	
Seattle	KETO-FM, KGFM, KZAM
WISCONSIN	
Eau Claire	WIAL
Green Bay	WBAY-FM
Milwaukee	WFMR

Chart information courtesy of *Television Digest*





Partially submerged, one of the two-man subs gets tryout in Mirror Lake at Fort Devens. Handgrips help the man in rear cockpit keep his seat.



Larger Scuba submarine at right is equipped with rear-view mirror and dual controls in front and rear cockpits. Smaller (left) is controlled only from front.

### Midget subs from surplus fuel tanks

Air Force Scuba divers at Hanscom Field, Mass., have converted two surplus wing-tip fuel tanks from an F-86 jet fighter into a two-ship U-boat fleet. Each sub carries two men in open cockpits submerged and towed by a powerboat.

Water-survival experts of the 3245th Operations Group built the subs from 120- and 230-gallon aluminum wing tanks. They cut out cockpits with a saber saw, installed controls to tilt diving planes so the subs can bank, roll, rise, and submerge. Since the craft require less exertion than swimming, divers use less air and can stay down longer.



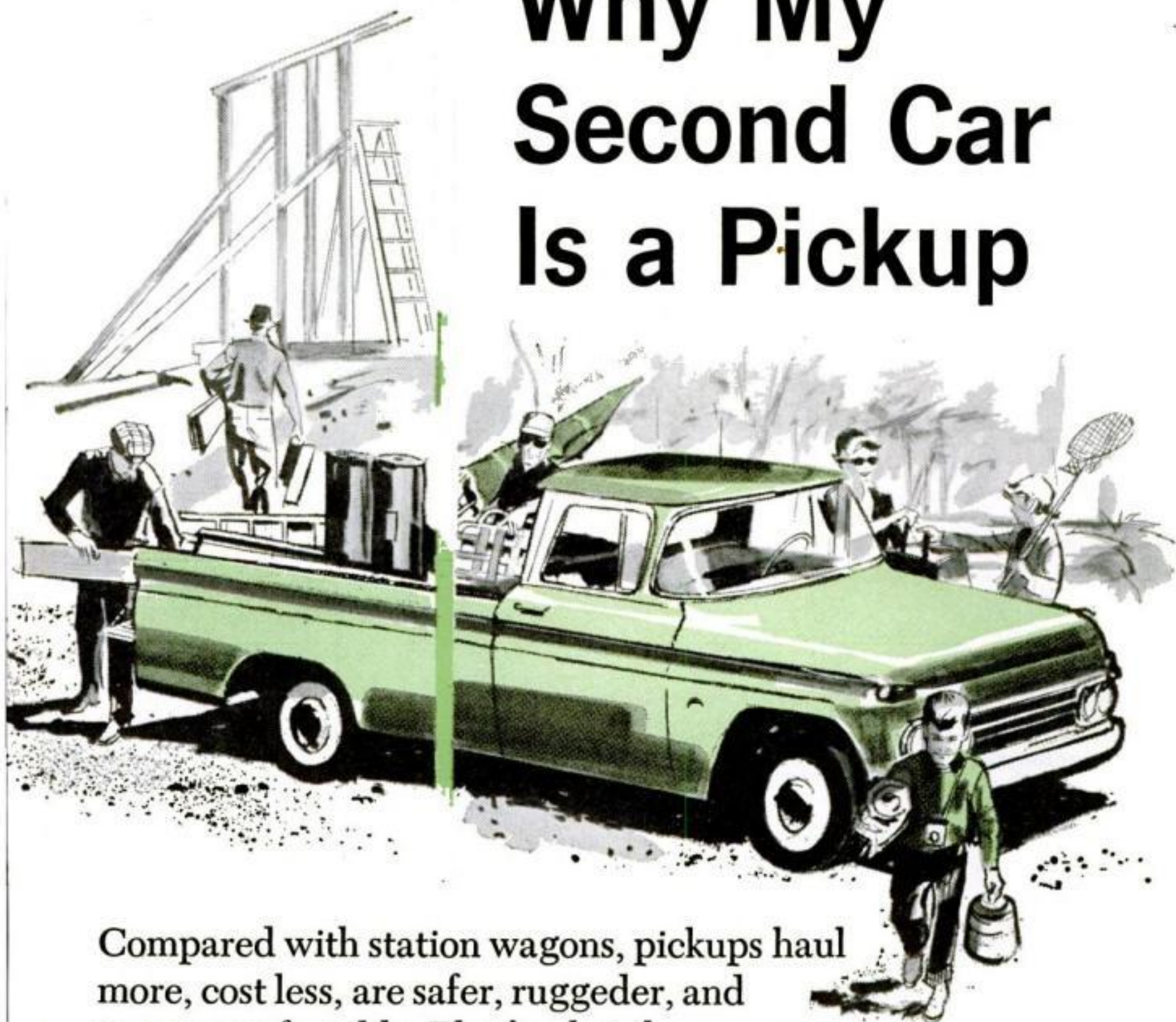
### Parking meter on booth times your snooze

What do you do when your lay-over between planes is long enough to bore you with sitting in the airport but doesn't offer enough time to go into town? In Shreveport, La., you catch up on your sleep in a Rest-O-Booth.

The booth, invented by Louis M. Gregory, local insurance salesman, contains a reclining chair, relaxing vibrator, ventilator fan, and fold-down desk behind a door that can be latched from inside. Put a quarter in the meter outside for each half-hour up to 12 hours, and you can sleep undisturbed until the time expires. Then the chair tilts up to wake you in time to catch your flight.



# Why My Second Car Is a Pickup



Compared with station wagons, pickups haul more, cost less, are safer, rugged, and just as comfortable. That's what the man says

By V. Lee Oertle

**W**ANT more than your money's worth when you buy a second car for your family? Buy a pickup truck. Ridiculous? Not a bit. I say a pickup, dollar-for-dollar, gives a family man more value as a second car than any vehicle he can buy.

I bought my first one two years ago. I'd never again want to go back to owning two cars that simply duplicate each other's function. Like most two-car families, we needed the second car so the

wife and kids would have transportation when I drive to work. Except for the nine-to-five stint, it sat in the garage and quietly soaked up installment payments and insurance while we went places together in the No. 1 car. A standard second car didn't earn its keep.

With a pickup it's different. The pickup pulls its weight in more ways than one. And if your lip is still curling slightly at the thought of a truck disgracing your front drive, that's only because you haven't been down to the showrooms lately to see what they're do-

CONTINUED



## Have you ever noticed how some drivers cut off a compact—but

ing with those half-tonners these days.

The workhorse look you remember from a few years back has been transformed into a sleek, flowing, tasteful silhouette. Styling shows a much stronger kinship to today's passenger cars than to the farmer's friend of yesteryear. Pickups come in fashionable colors, and seats are upholstered in sedanlike comfort. As any farm boy will tell you, the ladies like 'em; in ball gown or toredors, they can enter and exit with grace and dignity.

**Ride and handling?** Forget those old expressions, "rides like a truck" and "steers like a truck." My pickup steers



*Troublesome hauling jobs like getting home with four-by-eight plywood panels are painless when your second car is a pickup.*

easier than my neighbor's small foreign car. Sure, the ride is firm, but don't confuse that with a harsh or uncomfortable ride. I prefer it to the mushy wallowing of some of the big cars or the choppy pitching of some of the compacts.

As a mount for that modern trial by combat, freeway driving, I say the pickup can't be beat. It's safer and easier to handle in fast, heavy traffic than a big sedan or a tiny compact. The driver's eye level is several inches higher—so you can spot trouble brewing seven cars ahead.

The freeways are notorious brake killers. Repeated braking from high speeds generates more heat than many passenger-car brakes can take without fading.

Pickups have heavy-duty brakes, larger wheels, and brake drums better exposed to cooling air. If you should get rammed, you're better protected by the heavier shell. And the crumpled sheet metal is likely to be less expensive to repair.

An intangible also works in your favor. Have you ever noticed how the aggressive driver of one of those tail-finned monsters shamelessly cuts off a compact, but maintains a shy respect when his adversary is a pickup?

What about economy, you say? I admit a big V-8, even with stick shift, won't match the four-cylinder corn-popper in the average small import. But compared with most American compacts, the savings wouldn't keep a chainsmoker in cigarette money. My V-8 averages 18 m.p.g.—not much less than the 21 m.p.g. my brother claims for his compact. With a six, I'm sure the pickup would prove no thirstier than most compacts.

And you'll be tickled to learn that truck dealers are eager traders. List on my half-ton came to \$2,800 (with V-8, deluxe cab, radio, heater, and long box bed), but I easily chipped the price down to \$2,220. A few phone calls is all it took to get my pickup for \$250 under the cost of a standard two-door sedan.

**After you buy a truck**, your first move is predictable: You'll willingly haul away that accusing pile of leaves and pruned limbs from last year—without paying six bucks for trailer rental. You'll discover, as I did, how easy it is to load the low bed with the tailgate dropped. Next, you'll probably bring home those four-by-eight panels from the lumberyard—the ones you couldn't get in your car last week.

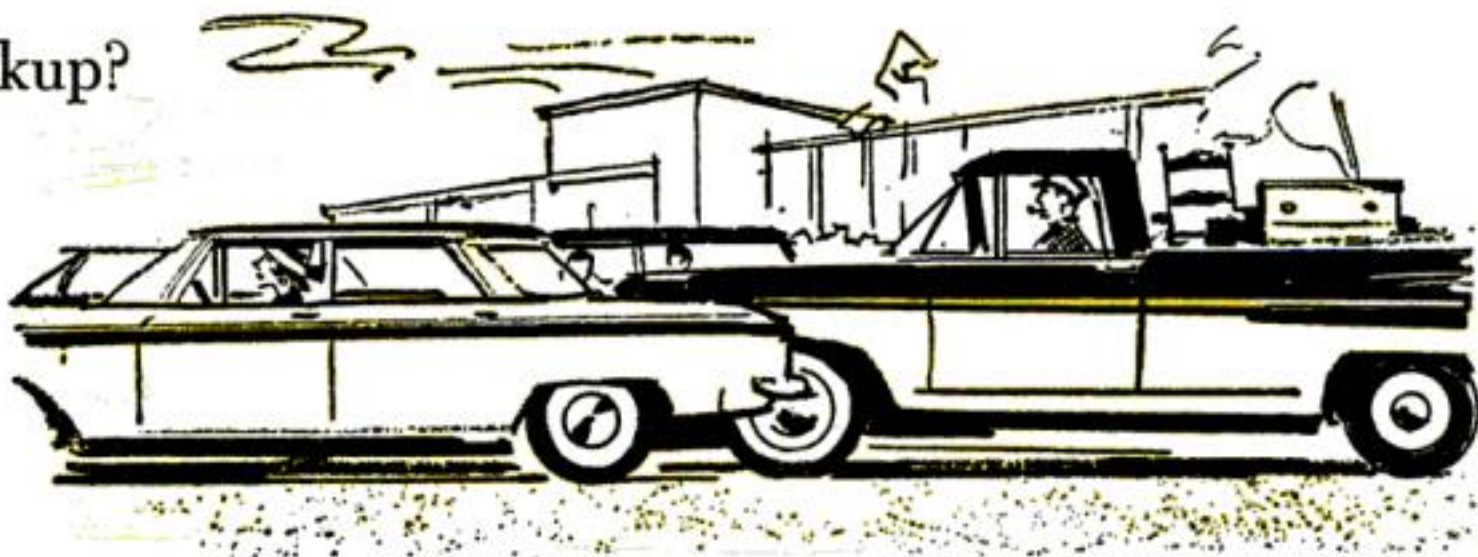
And when you bring home that bargain kitchen range you spotted in the classifieds, or a load of firewood "free for the hauling," you'll be convinced that you picked a winner when you picked a pickup.

On rainy days, I stretch a canvas cover over a light pipe framework built on the



## respect a pickup?

*Auctions become more of a hazard when you own a pickup. It's easy to be tempted by a bargain when you don't have to pay for delivery.*



bed of the truck. This same arrangement doubles as a sleeper on fishing and hunting trips. Stove and cots are kept high and dry inside the truck bed.

**When you're towing.** As delivered, a light truck is a superior vehicle for towing boats and trailers. Suspension is firm, tires husky, ground clearance excellent. The power train is geared for rugged work. Passenger sedans need heavier shocks, beefed-up springs, radiator coolers, special equalizing hitches. Light trucks, by contrast, offer heavy-duty radiators, electrical system, tires, and frame. You're ready to tow with the addition of a hitch.

On my station wagon, a mere 150 pounds dropped onto the rear bumper tilts the nose skyward. Add passengers in the rear seat, pile in luggage, and the car looks as if it's set for blast-off.

**Driving over rough terrain.** If you're heading into really remote country this summer, chances are the roads will be

deeply rutted. Light trucks have several inches more ground clearance than low-slung sedans. They'll take you farther more safely, with less danger of getting hung up. Fording small streams will be easier. The engine and exhaust pipe are higher. The undercarriage is less vulnerable to sharp rocks.

But how about roominess? Pickups have only one seat. Well, this used to be true, but at least two companies have solved the big-family dilemma. Dodge and International Harvester now offer four-door two-seat, six-passenger pickups.

For the normal family of two adults and two kids, my half-ton truck has been ample. My truck cab is 2½ inches wider *inside* (where it counts) than door-to-door in my station wagon. In a pinch, two adults and two kids will fit up front without crowding the driver. It's more comfortable than with three in the front seat of a compact, or two in the front of many foreign cars. But remember, we're talking about a second car. One or two persons is a normal load.

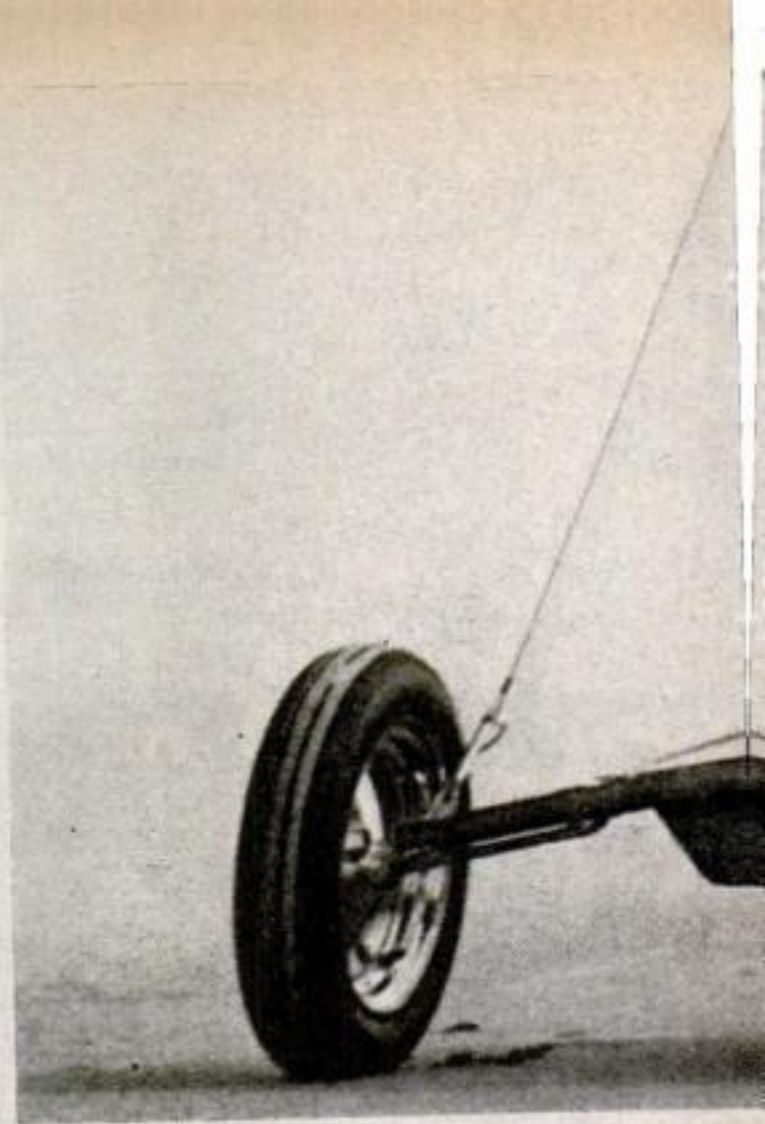
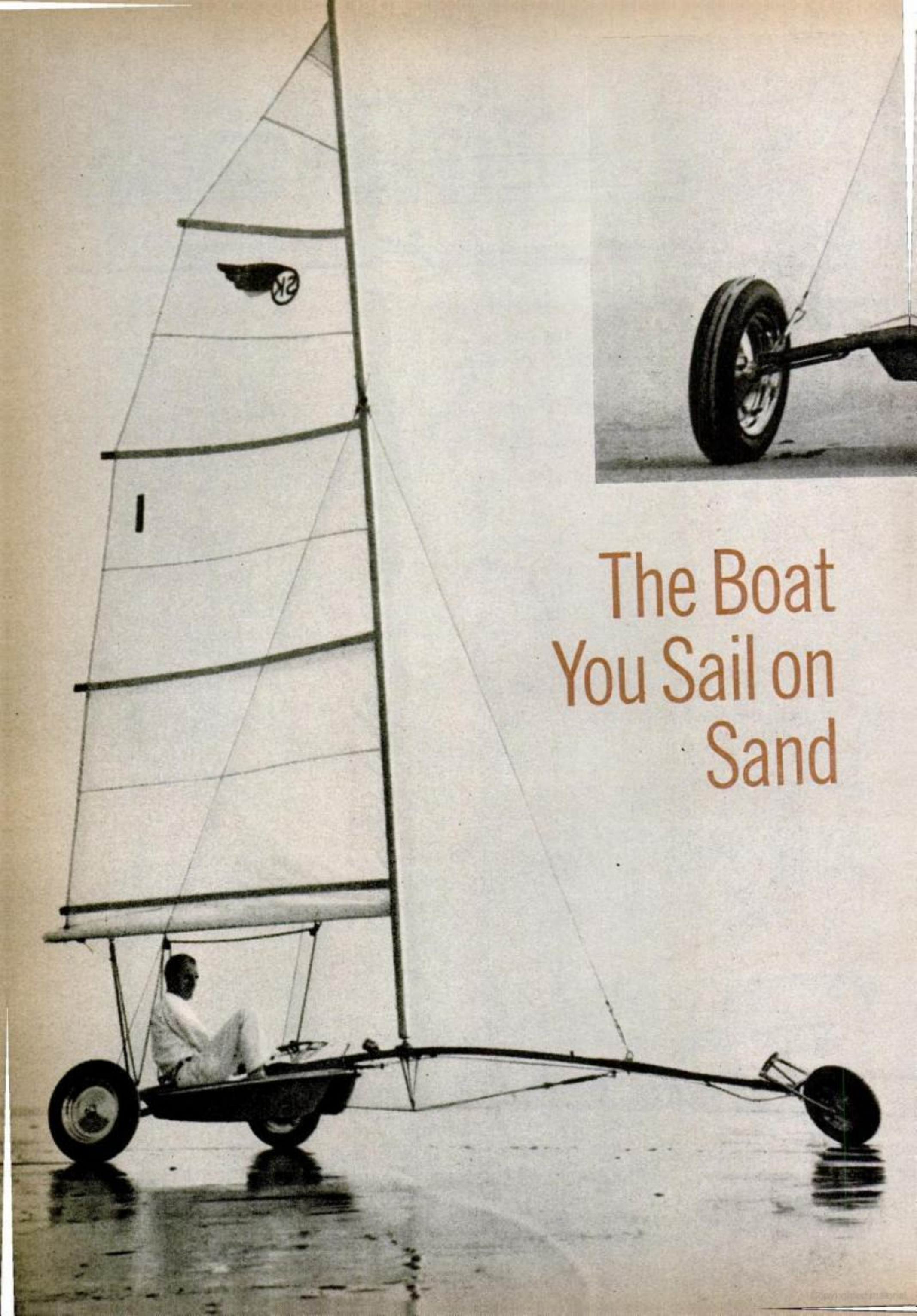
I won't belabor the more obvious advantages of a pickup, such as the ability to handle a camper body with built-in luxuries. Nor will I stress the benefits for construction workers and part-time job holders with tools to tote, packages to deliver, crates to haul. Nor frighten you with tales of the modest cost of retaining walls when you can haul your own stones.

The longer I use mine, the more I'm convinced that the pickup is the best buy for two-car families. For backwoods trail blazing or freeway driving, I wouldn't settle for less. ■ ■



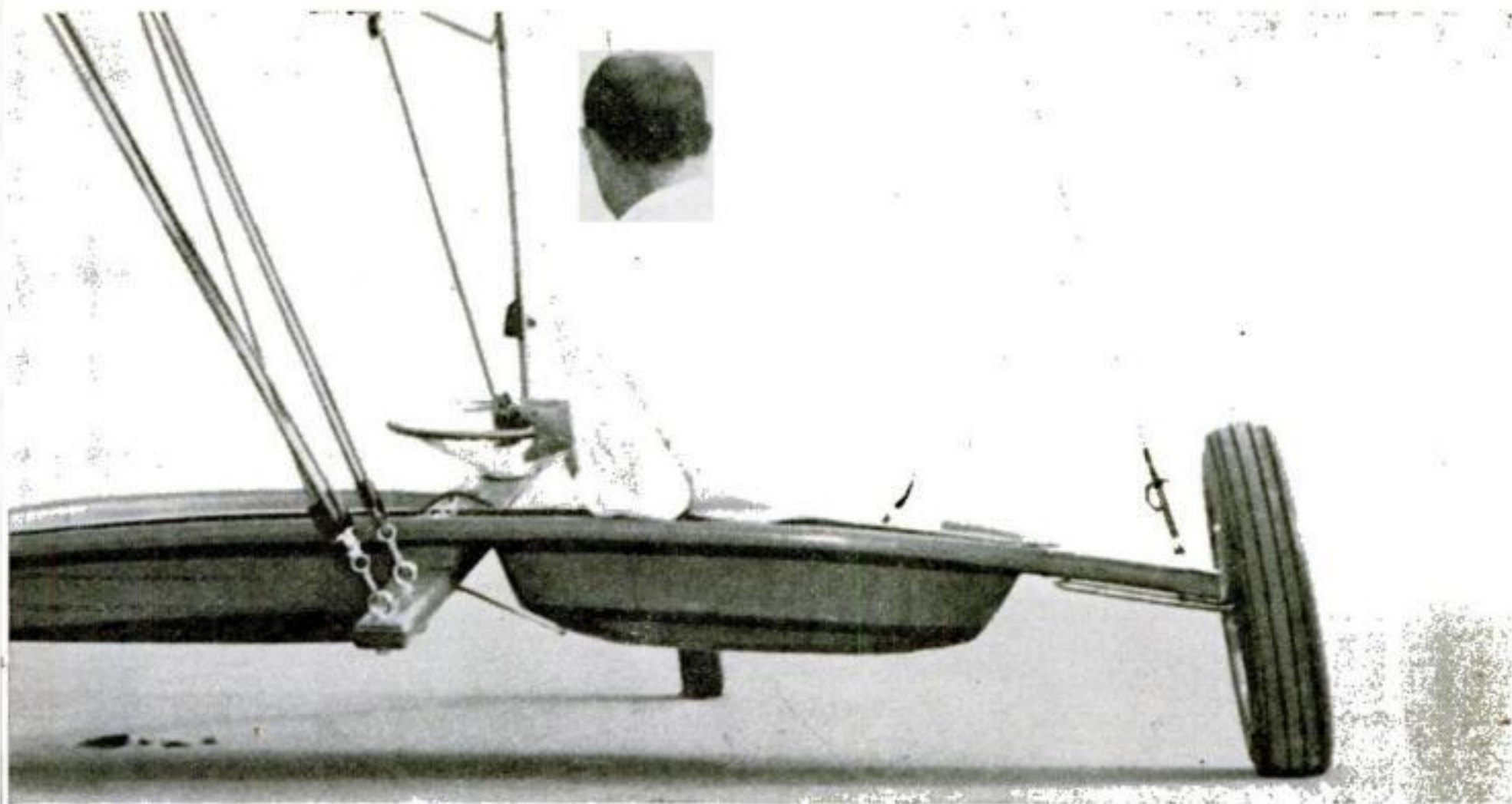
*With cars built as they are today, a pickup is the only vehicle to own that is really suitable for towing a trailer.*





# The Boat You Sail on Sand





Land Yacht's rear axle is a flexible arc of laminated fir. At high speeds it flattens out because

of wind pressure down through mast. Back wheels cant inward for added stability.

**T**HIS sailboat is for landlubbers only. It has neither rudder nor keel, and will never crest an ocean wave. It has wheels instead—three of them—that scoot it over any flat surface: beach, prairie, desert, even a parking lot. Speed? With a five-mile puff behind her, the Land Yacht will pick up to 20 m.p.h. Push her a little harder, say with a 20-m.p.h. breeze, and she'll do 50.

The Land Yacht steers through the front wheel. Her steering wheel, mounted amidships, is connected by cable to a 4.00-by-8-tired front wheel. The two rear tires are larger—4.00 by 12—for balance.

Rigging is simple and fairly loose. The main sheet runs through five pulley

blocks and is cinched into two jam-cleats in the center of the steering wheel.

The cockpit is divided into pie-shaped pieces, convenient if you singlehand her and need to hop around to hold her down. But the boat's big enough to hold three.

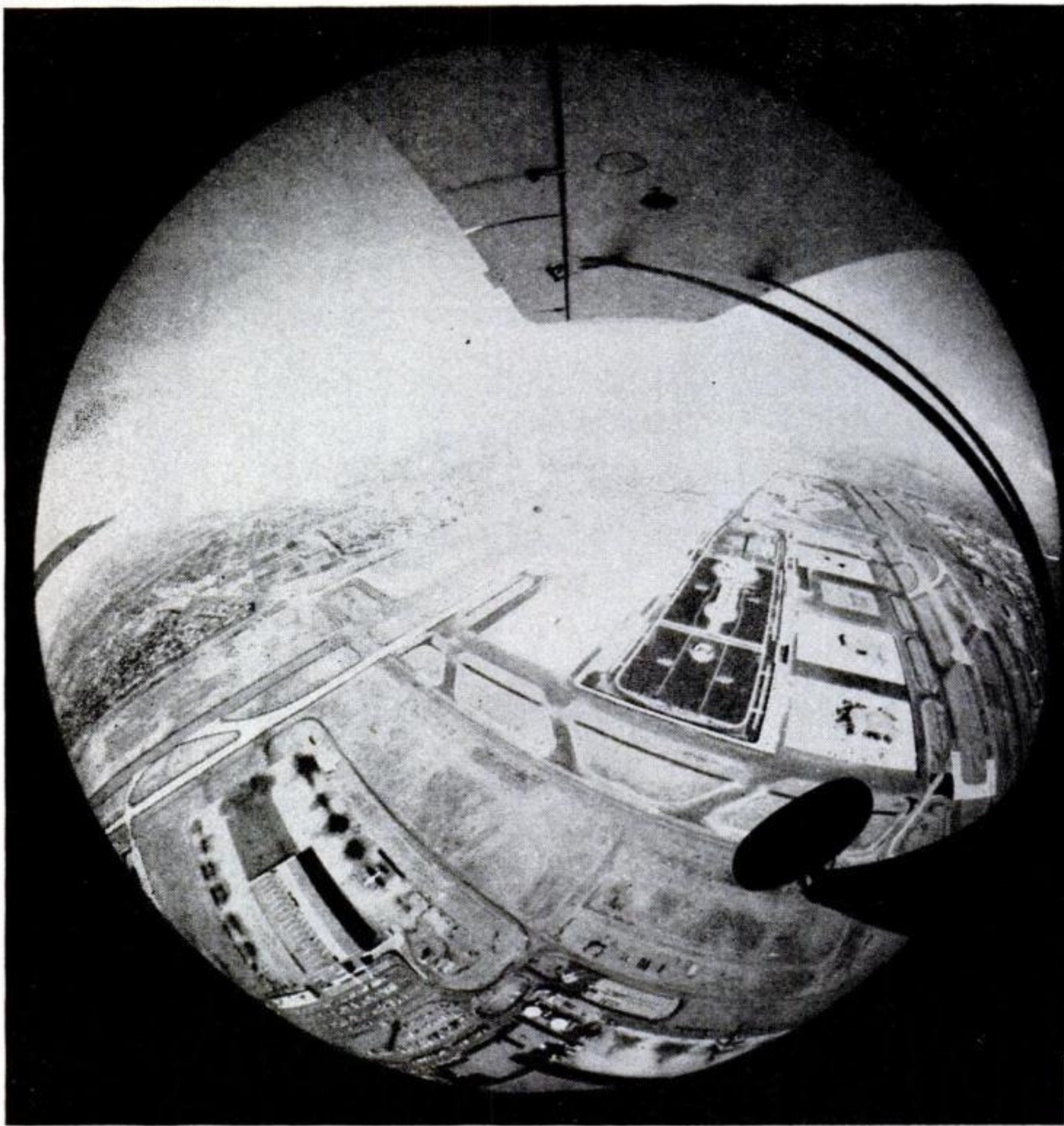
At California's Newport Beach, the boat is sold (by Rick Von Schlegell and Bud Hulst) for \$1,100, complete with aluminum mast and dacron sail. It was designed by Don Rypinski and Ian Critchley.

With the mast on your car roof, it's a simple matter to tow the hull out to the beach for a day's silent sailing: Riding sand waves, the little craft is as silent as the wind itself.—V. Lee Oertle.

Front wheel is controlled by cables and pulleys, stopped by simple scrub-type brake. A turn of steering wheel or a tug on mainsheet allows a U-turn in a 45-foot circle at speed.







### How an airport looks through an extra-wide-angle lens

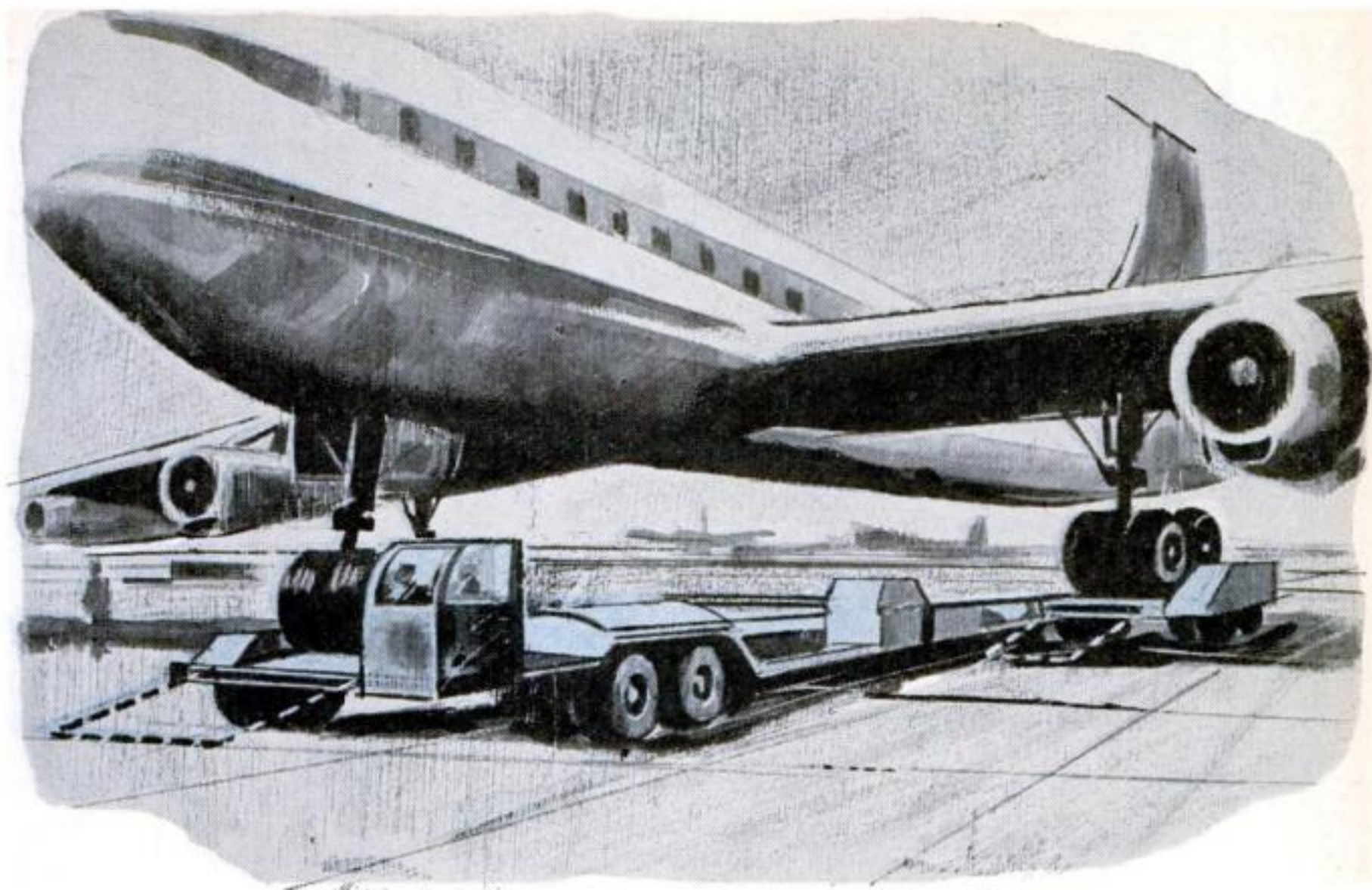
This photo of Los Angeles International Airport was taken at 500 feet with a hand-held Leica M-3 fitted with a special lens having a full field angle of 187 degrees.

A landing wheel of the Piper Tri-Pacer carrying the photographer shows up at the lower right, one of the wings at top, and a tip of the tail at left. On the ground are one of the runways at left, approach and taxiing runways across the center, a 135-foot-high parabolic-arched building at right center in the midst of the long, dark, rectangular 5,000-car parking area with the

172-foot-high control tower just behind it. At right are two of the seven completed "satellite" airline terminals from which radiate telescoping passenger ramps. Six more are being built.

The lens is a Paxar periphoto of 6.51-mm. focal length. It's made by Pacific Optical Corp., Inglewood, Calif., and is now being used largely in scoring the accuracy of missile strikes. It crams a lot of pictorial information into a .72-inch-diameter image and can be fitted on 16- as well as 35-mm. focal-plane cameras.





**Dolly taxis jet plane.** Air travelers might save time on the ground if this recently patented dolly were used to speed arriving jets to the terminal. Front and rear

ramps would let the jet climb aboard, to be driven to the passenger bay, and roll off later on the runway. The system would also save strain on the jet's nose wheels.

## New ideas from the inventors

**Cutter trims grass around pipe.** Instead of scissoring the lawn around an embedded sprinkler head, you'd preset the guides on this cutter for any trim height and center the base over the sprinkler head. A couple of quick twists would scythe the grass out to a safe mowing radius.



**Shoulder straps harness tray.** You could enjoy a beach snack in sand-free comfort if it was served on a table like this. Supported by a shoulder harness (and leveled by an adjusting screw), the table would free your hands to manage a picnic or TV meal without the usual bobbling.





## More inventors' ideas



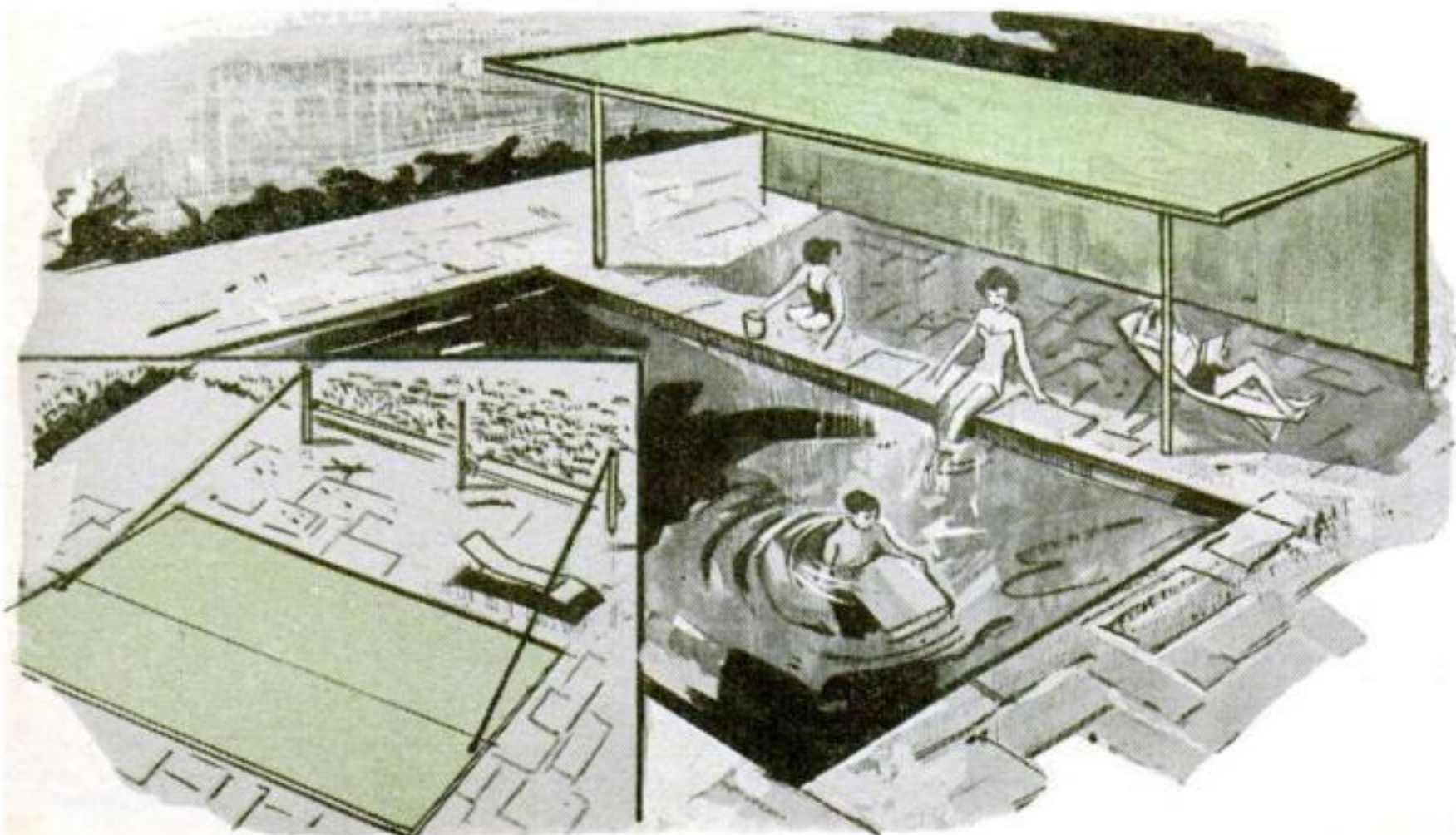
**Note pad clips to wheel.** A writing tablet mounted on the recessed hub of a steering wheel would let you write—and read—directions and other notes without taking your eyes off the road. At night, a small flashlight would illuminate the writing surface. The pad-and-pencil clip would clear the horn ring.



**Handle steadies you on ladder.** You could lean farther out from a top step of a ladder—or climb higher with greater safety—if you clamped this handle to the platform and gripped the upright post for balance. Fastened with wingnuts, the safety post could be positioned at any convenient point on the platform.

**Safety cover shades pool.** Winched up against vertical supporting posts, the lightweight-metal (or reinforced-plastic) panels of this pool cover would serve as a sun-

shade or windbreak. Let down when the pool was unattended, they'd protect children and pets, and keep out falling leaves or other debris.

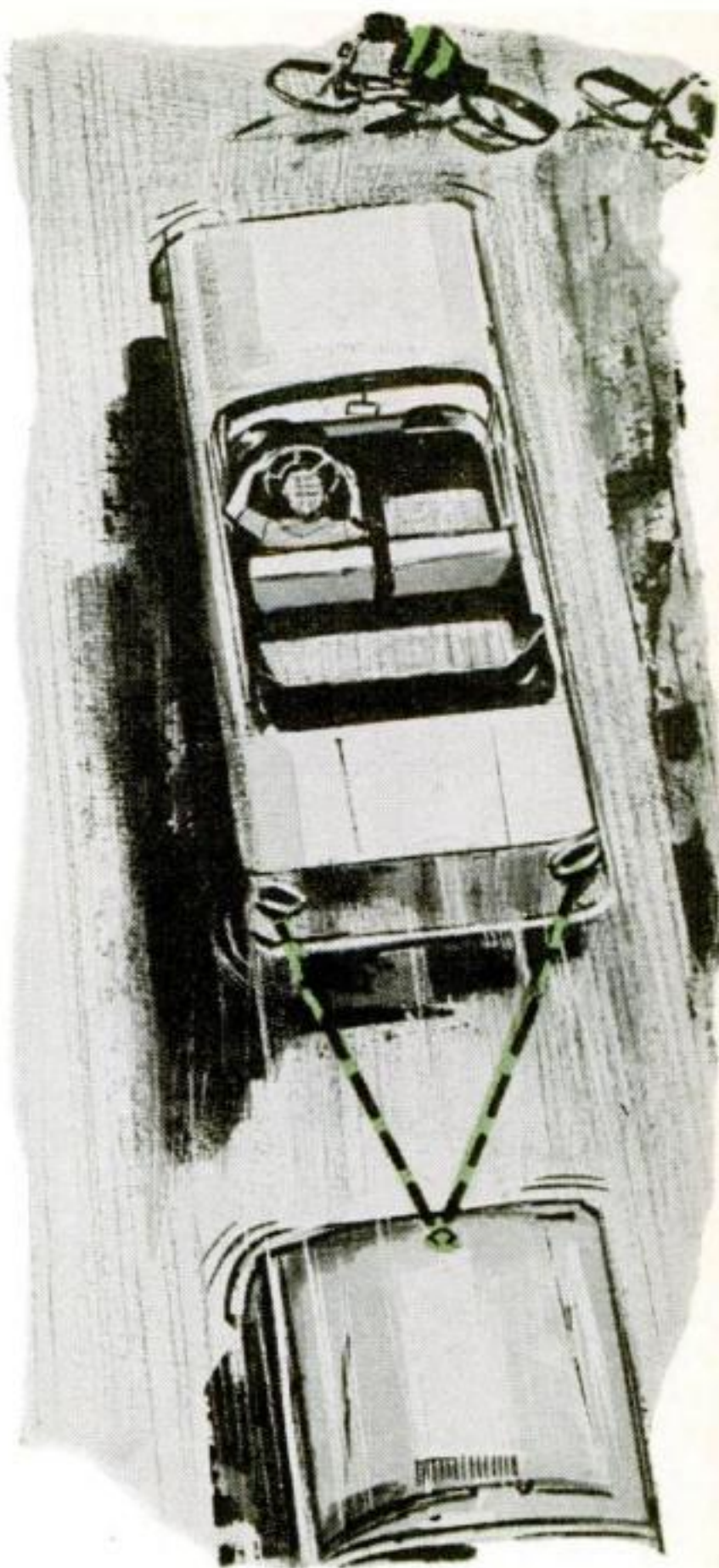
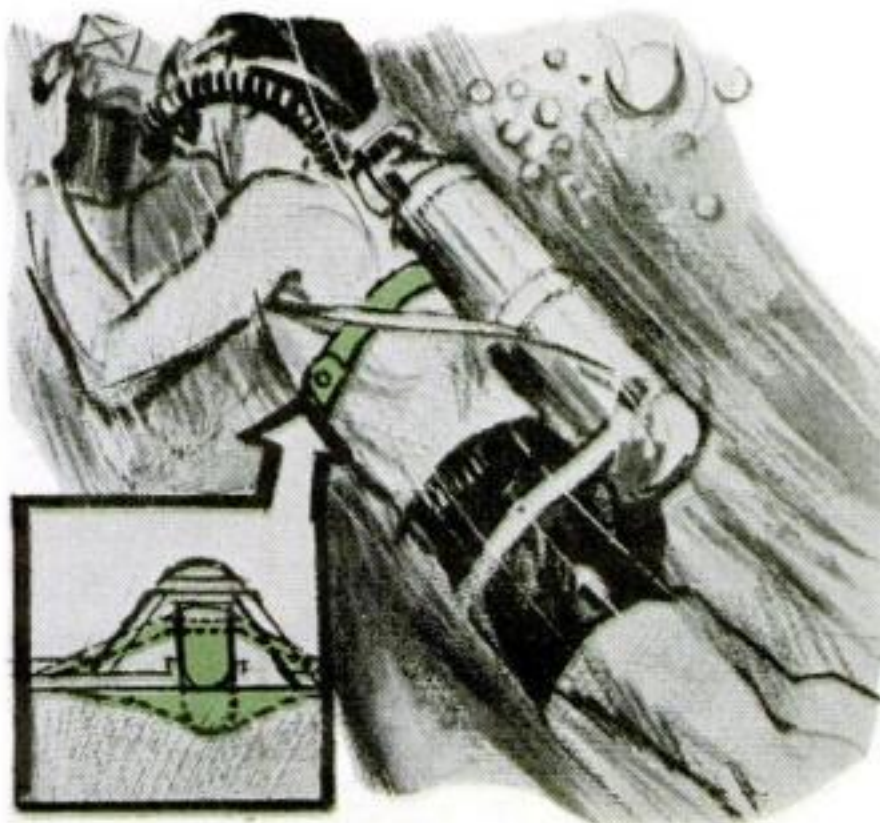






**Vacuum cleaner rides upstairs.** A let-down wheel under a vacuum-cleaner tank might simplify the job of rolling the machine up and down stairs. It would simplify stair cleaning, too, because the wheel would also act as a "stair holder" by chocking the tank. On a level carpet, the wheel would be retracted.

**Rib prod warns diver.** If a skin diver rises too rapidly and forgets to exhale, say these inventors, relatively high air pressure in the lungs can cause serious—even fatal—injury. To remind him to exhale, a plastic button on this belt would poke a diver in the ribs whenever abnormal lung pressure expanded his chest.



**Brake lights slow trailing car.** The dangers of rear-end collisions might be reduced, according to this GM patent, by an electronic system that would slow your car when brake lights flashed on the car ahead. It would sense a brightness increase and adjust your throttle or brakes.

*The following patents have been issued on these inventions: Jet Carrier—No. 2,980,270 to D. Elliott and R. Gibbens, Miami; Grass Cutter—No. 3,001,286 to R. Peasler, Salinas, Calif.; Tray—No. 3,009,613 to W. Noland, Avon Lake, Iowa; Car Pad—No. 3,011,802 to E. Ackerman, Cuyahoga Falls, Ohio; Ladder Grip—No. 3,013,627 to A. Haislip, Fredericksburg, Va.; Pool Cover—No. 3,002,195 to J. Prudek, Fresno, Calif.; Vacuum Cleaner—No. 3,015,123 to R. Descarries, Montreal, Can.; Rib Sticker—No. 2,989,050 to A. Mayo, Palos Verdes Estates, and H. Garrard, El Segundo, Calif.; Brake—No. 3,011,580 to J. Reid, Little Rock, Ark.*

*Copies of patents may be ordered, by number, from the Commissioner of Patents, Washington 25, D.C., at 25 cents each. To write to an inventor, if the address given above is insufficient, address him (by name and patent number) in care of the Commissioner of Patents.*



## Self-inflating balloons that harden in space

Scientists are seeking a satellite fabric that will remain flexible during a missile's trip into orbit and become rigid when let loose in space. Working together, Westinghouse and the Air Force have come up with one such material. Fiber-glass is the base fabric. It's coated with a special liquid containing both a softening agent that keeps it flexible while it is packed, and an extracting fluid that evaporates the softening agent when the material is inflated. Scientists believe the satellite would be kept rigid even if punctured in space by meteorites.



Folded balloon is placed in a vacuum chamber for its simulated flight into outer space.

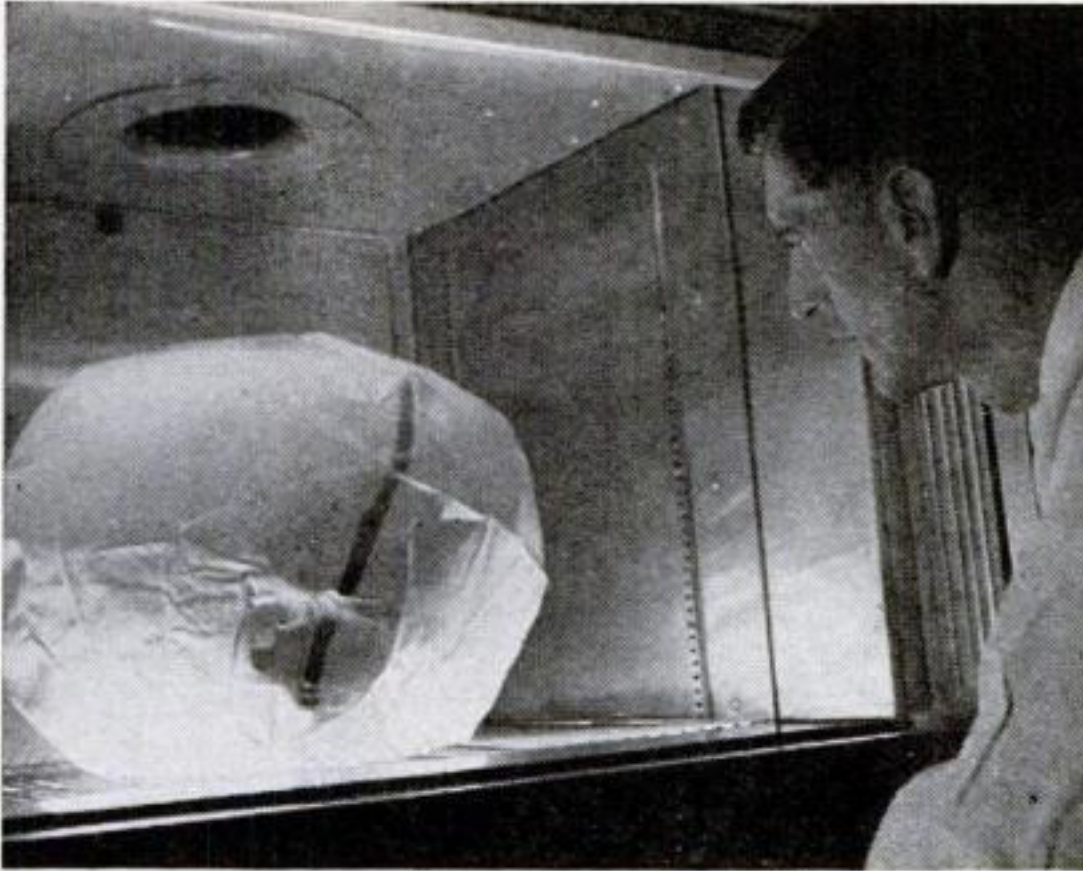


## Rescue platform added to helicopter

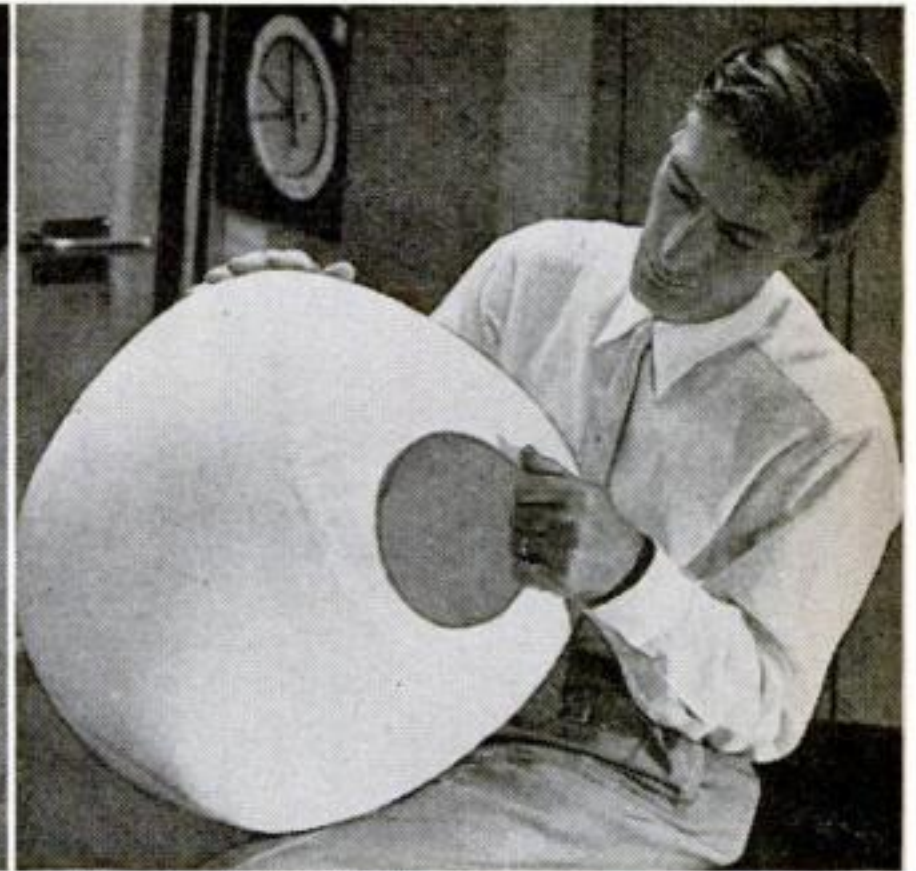
A metal platform has been installed by the Coast Guard in its latest amphibious helicopter for use in rescues at sea. With the platform pushed through the door of a

Sikorsky S-62, a crew member can reach out and lift a man from a life raft. He's strapped to the fuselage to keep from falling in himself. The method is faster than hovering overhead and dropping a hoist to pick up the floating survivor.

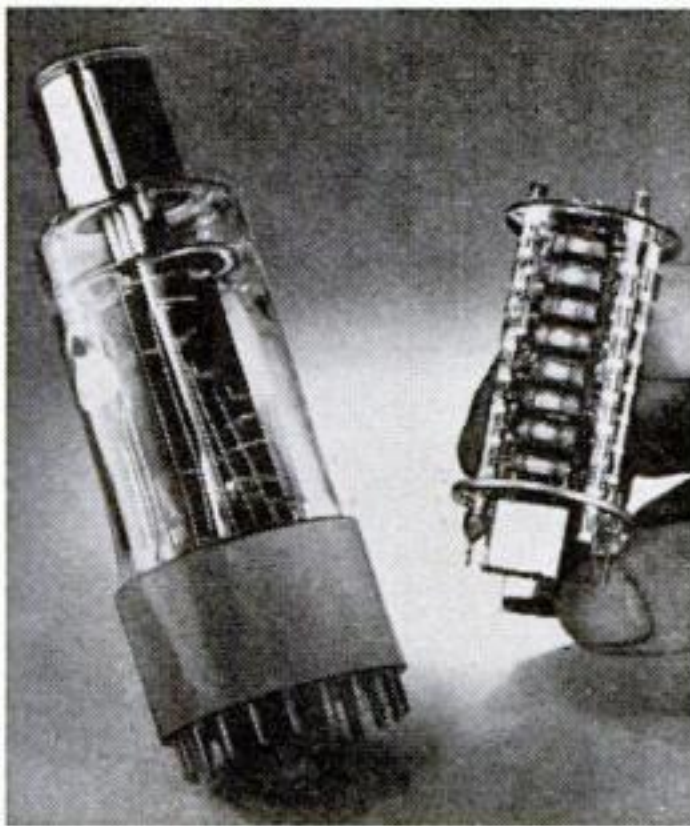




**Inflation of sphere** occurs gradually as air is pumped out and vapors inside fabric evaporate.



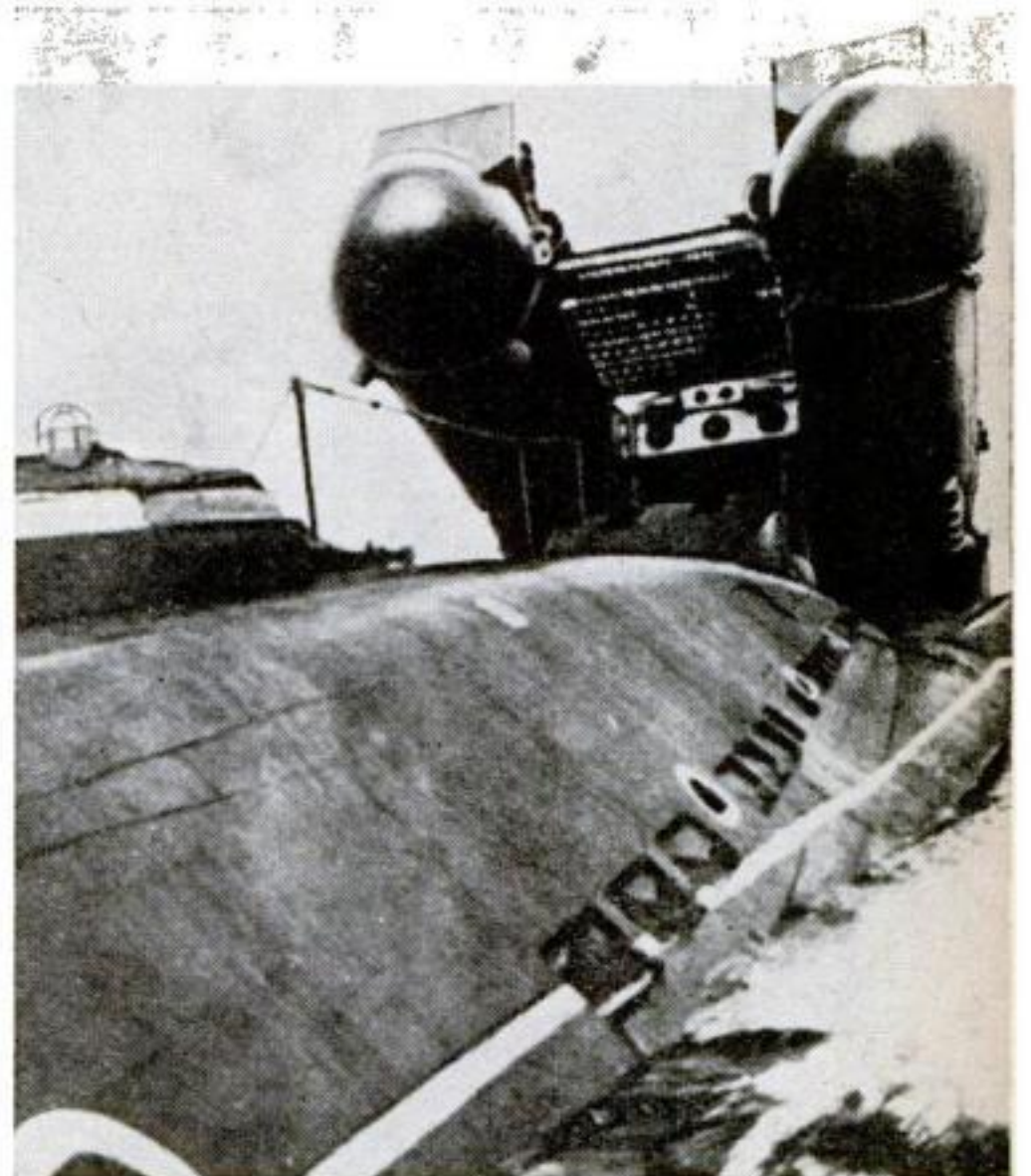
**Sphere retains shape** without internal pressure after hardening. Even a hole doesn't collapse it.



### Tubeless tubes for satellites

For use in outer space, which itself is a vacuum, a vacuum multiplier phototube has been developed by International Telephone and Telegraph with the usual glass envelope purposely left off.

The tube produces an electric signal proportional to the brightness of the light shining on it and is rugged enough to withstand the firing of a rocket. Omitting the glass eliminates its filtering effect and gives the tube a wider range of sensitivity.



### Russians' rocket-firing submarine

This first picture of a Soviet rocket-carrying submarine appeared in *Red Star*. Unlike American Polaris subs, which fire from under the water, this one apparently has to surface like our original ones equipped with Regulus missiles. It is shown, say the Reds, "raising its rocket containers over the water, ready to swoop to their target."



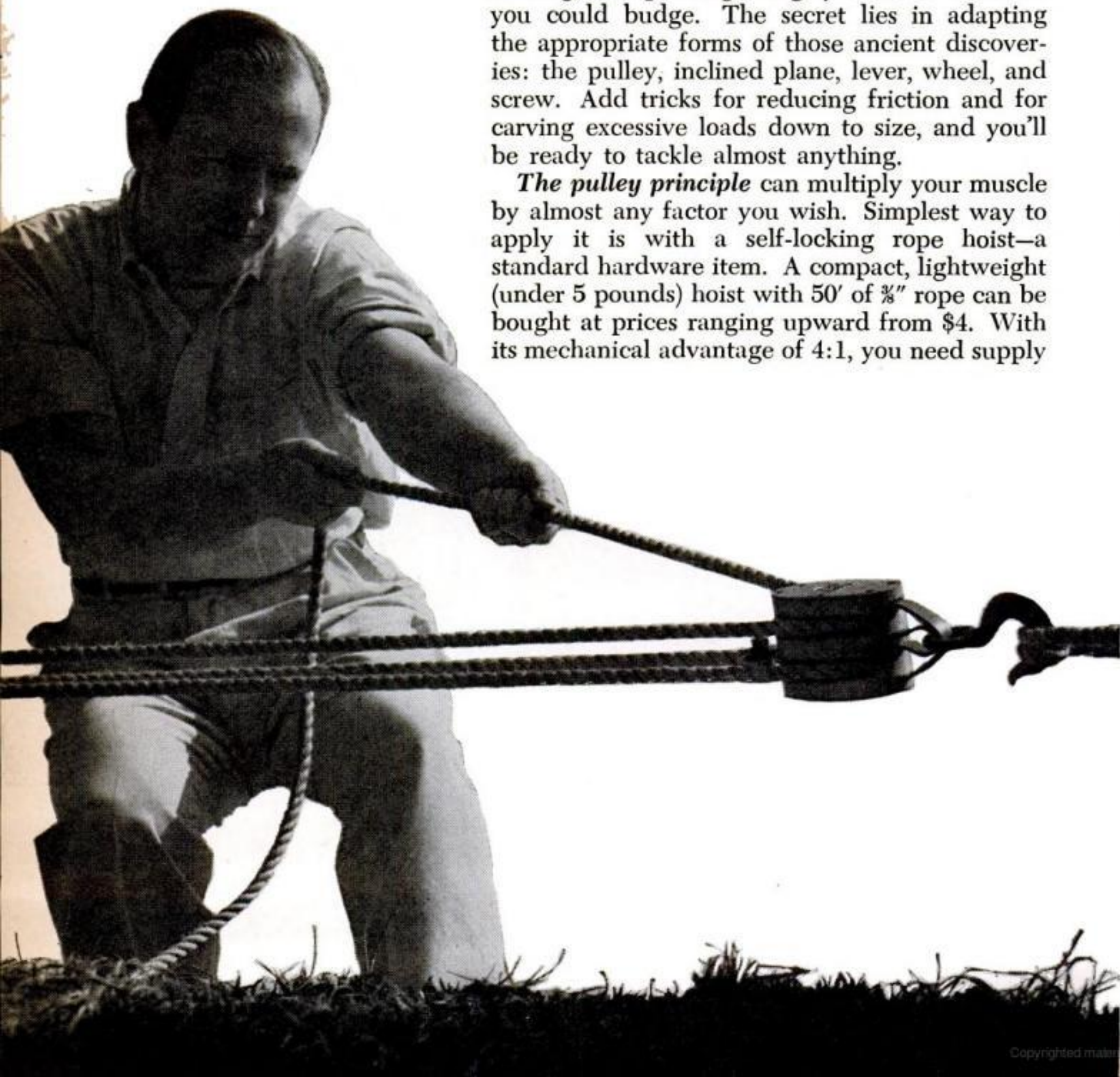
# 13 Ways to Multiply Your Muscle

By  
Darrell Huff

ANYONE who keeps up a home, car, workshop, or garden is bound to run into jobs that call for more than human strength. Even the chain-busting strong man in the sideshow would be baffled by many of them.

But if you'll learn to apply principles of mechanical advantage you'll find yourself lifting, moving, and pushing things you never dreamed you could budge. The secret lies in adapting the appropriate forms of those ancient discoveries: the pulley, inclined plane, lever, wheel, and screw. Add tricks for reducing friction and for carving excessive loads down to size, and you'll be ready to tackle almost anything.

*The pulley principle* can multiply your muscle by almost any factor you wish. Simplest way to apply it is with a self-locking rope hoist—a standard hardware item. A compact, lightweight (under 5 pounds) hoist with 50' of  $\frac{3}{8}$ " rope can be bought at prices ranging upward from \$4. With its mechanical advantage of 4:1, you need supply





# Power

only 125 pounds of pull to swing a quarter of a ton into the air. That lets you handle such formidable items as an automobile engine, a washer-dryer combination, a cast-iron bathtub, or a big steel fireplace unit.

Spend about \$8 and you can have a similar hoist that will handle three-quarters of a ton.

For frequent use or heavier jobs, there are chain hoists (beginning at about \$30) with a safe-load capacity ranging from half a ton on up.

Most amazing of pulley devices, however, are the midget pulley blocks sold under such names as "Little Lifter." Intended for sportsmen and motorists, they are pocket-size tools that weigh less than a pound yet can lift half a ton. They're likely to have polished brass or brightly chromed blocks and colored nylon cord. Usual price range is \$10 to \$15. Their light weight and tiny size make them easy to carry on hunting trips or stow in the glove compartment.

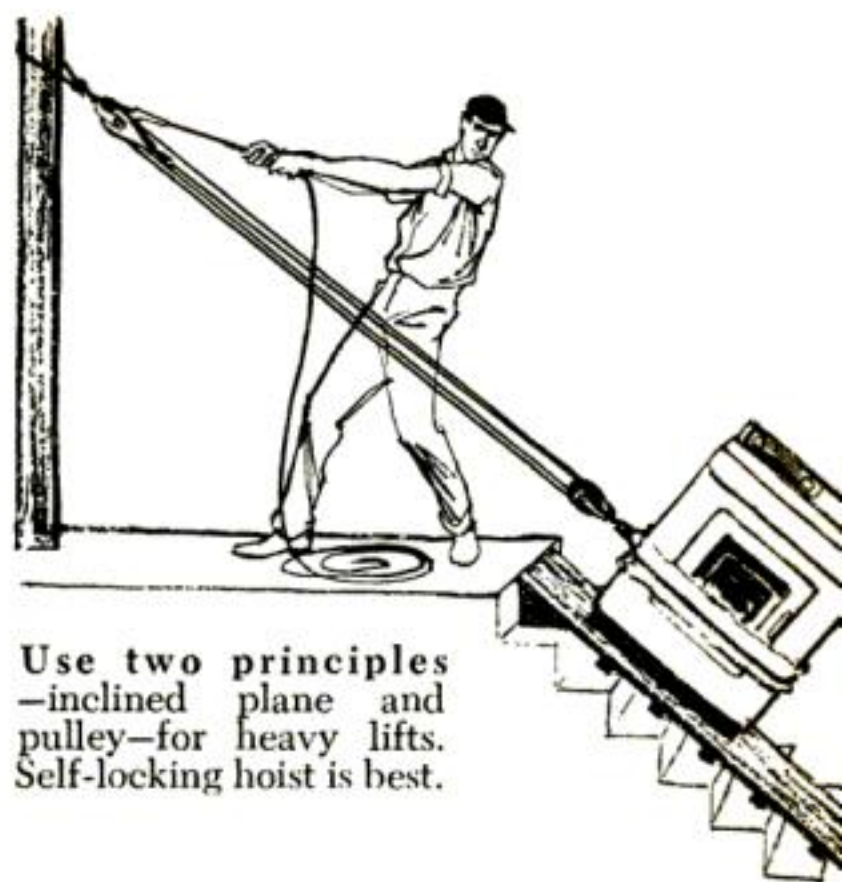
**The inclined plane**, as applied to more than man-size jobs, is usually some kind of ramp, plank, or chute.

To convert a station wagon into a long-haul wheelbarrow, equip a stout plank or piece of heavy plywood with hooks or a cleat that will keep it from slipping off the tailgate. Loads you could never lift can be eased up or down the plank. For some of the heavier tasks add a second principle—the wheel—in the form of two or three short pieces of pipe used as rollers.

Chutes are especially helpful to people who live on hillsides or on split-level tracts. Without some kind of chute, moving heavy objects or massive amounts of such loose stuff as gravel, topsoil, or concrete can be rugged.

Chutes are usually wooden channels; but to make one in a hurry, bow a length of corrugated aluminum or steel with baling wire. Add a second length to make a longer chute. Cheap used or damaged sheets do as well as new.

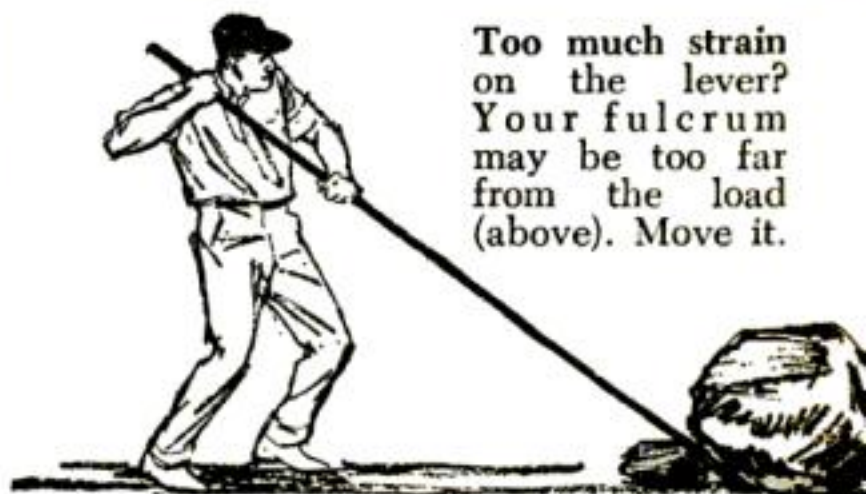
**A lever** can be contrived from almost anything you have around that's long and strong. Its



Use two principles—inclined plane and pulley—for heavy lifts. Self-locking hoist is best.



Make a chute by cleating planks together. Angled into a concrete form, it short-cuts a nuisance embankment.

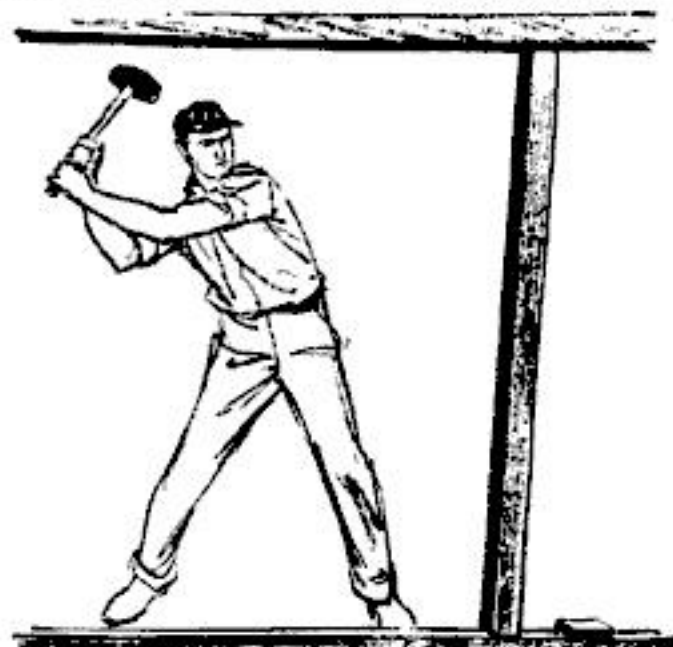


Too much strain on the lever? Your fulcrum may be too far from the load (above). Move it.





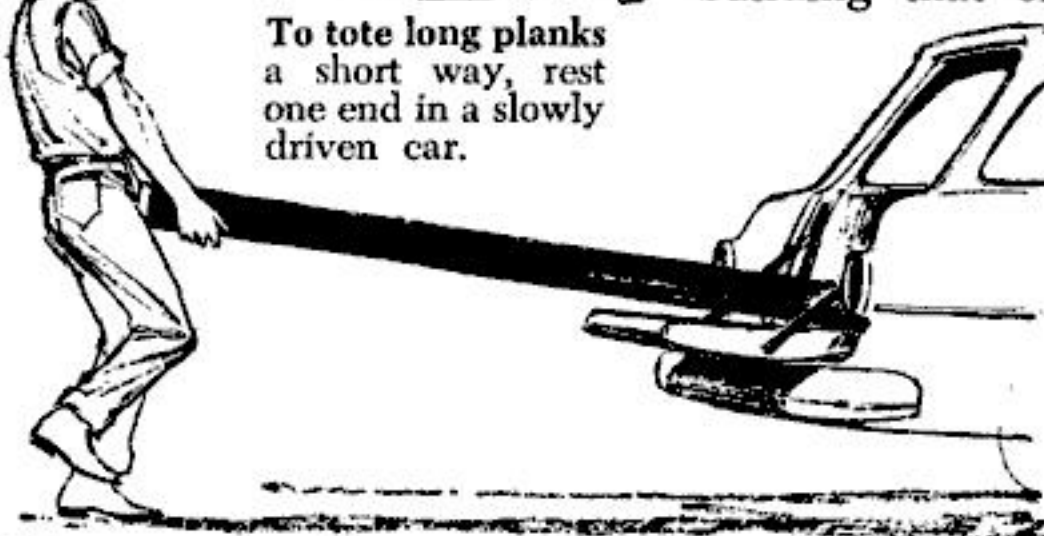
Use staked four-by-four as a slip prop when you plumb a wall.



Straighten beam by wedging in a post cut to proper height.



Jack post also lifts sagging beams so you can slip in new support timber.



To tote long planks a short way, rest one end in a slowly driven car.

handiest forms are crowbar, pinch (wrecking) bar, shovel, and timber.

A crowbar is a many-purpose lever especially useful for working with rocks and heavy timbers. Use a pinch bar for smaller jobs and tighter spaces, particularly in carpentry and other woodworking operations.

When moving rocks, keep a shovel or spade handy to act as an auxiliary lever. Use it, too, when prying up things that squat too close to the ground to let you get under with any other kind of lever. The sharp blade will make its own way under a heavy box or crate. It provides its own fulcrum and makes so effective a lever you'll have to take care not to damage it by putting too much pressure on the handle.

A timber offers the advantage of real length—up to 20' or so. With the point of force no more than a foot from the pivot, a fair-size man hanging on the other end can lift one wheel of a heavily loaded pickup truck out of mud. His weight is worth a ton and a half in this arrangement, and the weight of the lever itself adds a useful bonus.

Well known to all, but easily forgotten in the stress of the job, is that your mechanical advantage is equal to the distance from you to the pivot point divided by the distance from the pivot to the object you're working on. So keep the fulcrum close to the load.

Often overlooked, too, is the fact that a lever can pull upwards as well as push, if you've got a high fulcrum, such as a free-standing masonry wall. All that's required is a rope loop or—better—a chain passed around the object to be raised and fastened to one end of your lever.

A prop is a sort of self-securing lever. It permits you to apply force by swinging a sledge, then nails down your gains.

To plumb anything—a big post, a section of wall, even a small building—lean a four-by-four or other timber against it. Stake the bottom of the timber securely. As you tap the structure with a heavy hammer, the timber drops to hold what you've gained. Even gentle taps with a light sledge will straighten a building that ordinary shoving, leaning, or tugging

wouldn't begin to budge. The same principle, applied vertically, can straighten a sagging horizontal beam. Cut a post to the height the beam *should* be, tip it as nearly into place as possible, and spike the top to the beam. As you drive the bottom of the post toward a vertical position, you'll exert tons of upward pressure on the beam. Friction,



again, will hold the tiny gain from each hammer blow.

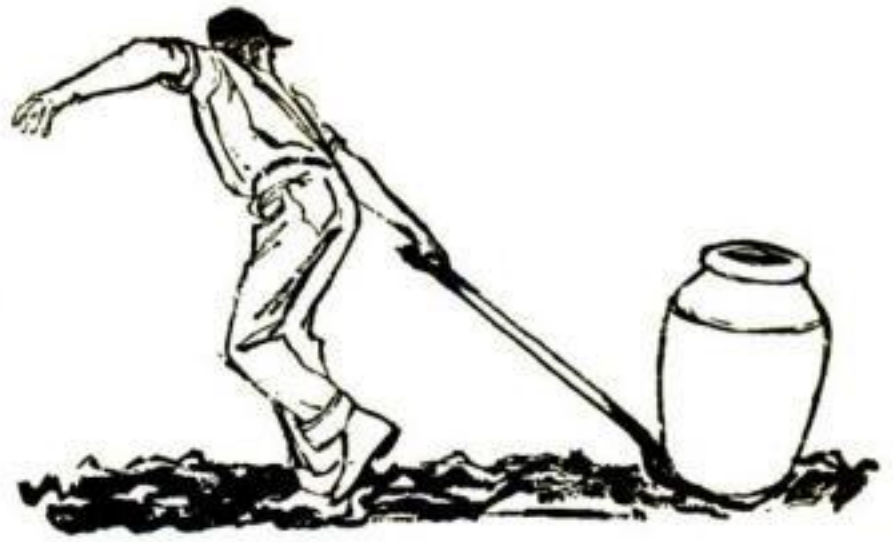
**Wheels** will help you move things your unaided strength couldn't begin to. And wheels are all around you, waiting to be used. Adapt a child's wagon or scooter, a wheelbarrow or a garden cart to your needs. Borrow or rent a hand truck to move heavy appliances wherever sliding them is impossible. On smooth outdoor surfaces, use a couple of short pieces of pipe as rollers.

For frequent use, it's worth while to make a special truck. With three or four stout casters you can turn a piece of plywood or two cross-lapped short planks into a truck for handling such hefty things as earth-filled planter boxes.

Your car can supply the wheels even for jobs that at first seem beyond its capacity. How would you move a 300-pound 20' timber up a narrow road? That's a tough carry, even for a couple of husky men. With someone else to drive, let your car support one end of the timber while you hold up the other. Given a station wagon with bed and tailgate that add up to as little as 8', you'll have to carry only 60 pounds of the 300.

*The principle of the screw*, applied in the form of a jack, lets you multiply your muscle by enormous factors. How else can you lift 10 tons with one hand?

[\[Continued on page 190\]](#)



Broad-bladed shovel serves as sled for loads you can't lift. Tip object, slip blade under.



Equip heavy planters with holes or handles you can slide a pipe through—and share the load.



Make carrying sling of heavy canvas to tote loads too heavy or awkward for one man. With a couple of young helpers (left) 150-pound paving blocks are easy to handle. Heavier objects may take still more bearers.





**1.** Flat-metal chain runs flat over pulleys. This #15 pattern chain costs about 36 cents a foot. **2.** Each link of this #1/0 safety chain (about eight cents a foot) is cut from a blank, laced through preceding link, bent to receive next link. **3.** Commonly used on windows, #35 sash chain costs about eight cents a foot. **4.** The #4 loom friction chain is similar to safety chain, but is heavier. **5.** Half-inch proof-coil chain is rated at 6,850 pounds, costs about 90

cents a foot. It's useful for boat mooring, towing, log hauling. **6.** Lugs in X-weld chain add strength, prevent kinking. Half-inch size, proof-tested at 22,500 pounds, is about \$1.90 a foot. **7.** Economical for light use, single-jack chain has weldless wire links. The #12 size costs about six cents a foot in steel, 21 cents in brass. **8.** Double-jack chain, used similarly, is sometimes preferred for appearance. In steel, #12 size is about 7½ cents a foot; in brass, about 30

# Amazing Facts About Chains

From hairbreadth jewelry strands to 300-pound anchor links, man has found countless ways to employ this most versatile of human inventions





cents. **9.** Slightly stronger than jack chain, this safe or register chain costs about five cents a foot in #18 size. **10.** For running over pulleys, single-loop weldless chain is often used. The 995-pound-test #1/0 is about 11 cents a foot. **11.** Double-loop version is less flexible. Cost for 1,050-pound-test #2/0: about nine cents a foot. **12.** Useful on truck tailgates and other light jobs, straight-link #3/0 machine chain proof-tests at 1,125 pounds, sells for about 25

cents a foot. **13.** Twist-link machine chain in same size is about four cents a foot more. (No twist-link chain is proof-tested.) **14.** Add V-shaped lugs and you have snow chains. Eight-link Campbell cross chain carries 39-cent suggested price tag. **15.** Passing-link chain has links that can revolve and reverse ends, so is nonkinking for tying animals, its chief use. It's not proof-tested; a load half its strength stretches links. In #3/0: about 22 cents a foot.

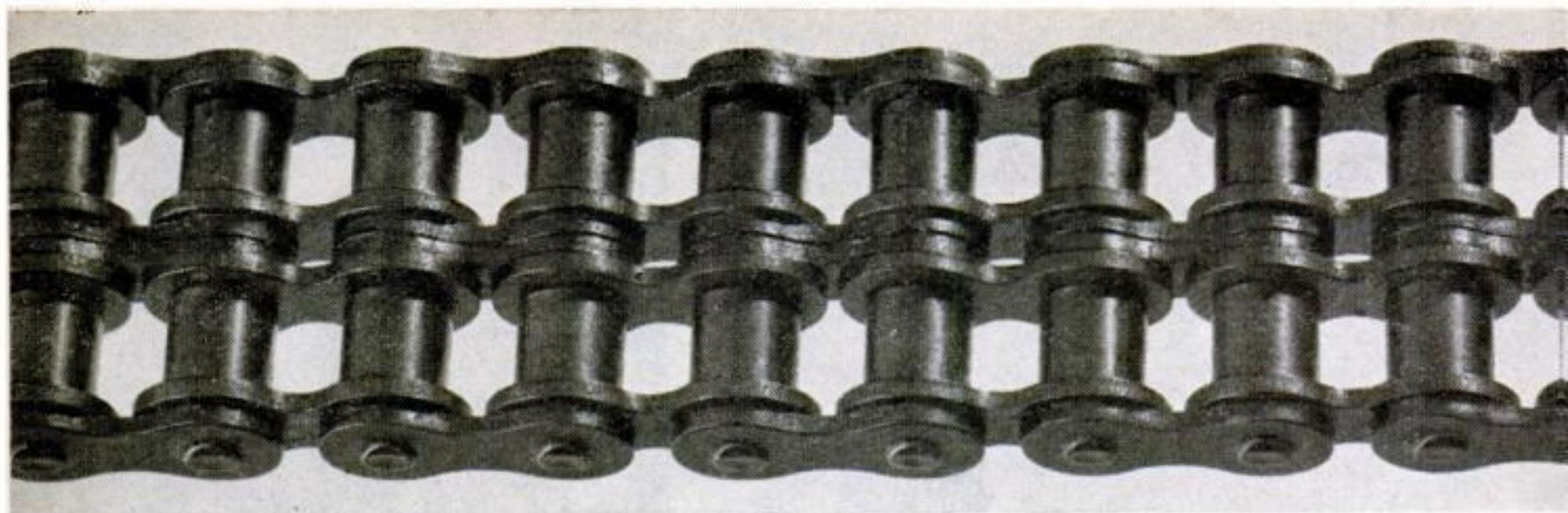
**I**F AN irresistible force ever does succeed in budging an immovable object, you can be sure they'll be linked by some kind of chain. Chain is the most flexible way to use the strength of metal. It is also the most versatile, and in many ways the most surprising.

Although chains are practically useless when you want to exert a push, they have never been matched in their ability to pull, or bind, or bend. Chains are the

quietest machine drivers you can find—and the noisiest. They are used for the smoothest connecting cables—and the roughest. In some hauling jobs, chains have more give than a rubber band.

This strange mixture of characteristics has challenged craftsmen for centuries. Chains show up in hairbreadth jewelry strands, in anchor cables weighing 300 pounds per link, and in in-between varieties that have never been counted.





**Single- and multi-strand roller chains** come in many sizes. Their best-known use is on bi-

cycles, but they also are used to transmit motion on the most delicate barometers, and power

Chains have turned the tide of battle, armored knights and adorned their jeweled ladies, and bound galley slaves to their oars. They have plowed the bottoms of oceans, confused tax assessors, lighted billions of lamps, debarked trees at lumber mills, and kept jet planes from overshooting their runways.

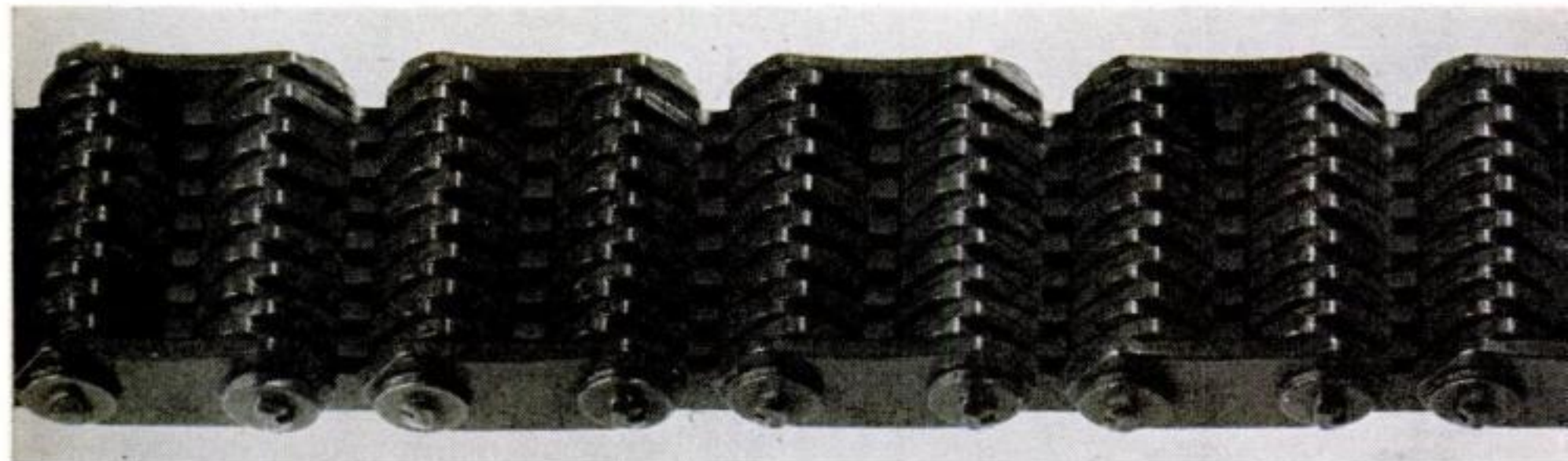
Perhaps the most memorable chain out of America's past was never even used—the 1,700-footer forged on George Washington's order to span the Hudson River at West Point and block passage of the British fleet.

**Calculated droop.** Chain is often made much stronger than it needs to be, simply to add weight. Western Union uses a mile-long, 21-ton piece of chain to haul a cable plow along the ocean floor, half a mile down. The chain's strength is at least double the 65,000-pound load it has to pull, but the excess isn't wasted. The overlong, overstrong

chain droops in what is known as a "catenary curve" between plow and ship. It can't snap taut without first lifting its multi-ton sag. This protects the plow, the ship, and the chain itself from snag or impact damage.

On more conventional ships, this elasticity increases the holding power of anchors. The huge aircraft carrier USS Independence needs only two 30-ton anchors to hold fast in the roughest swells. If the anchors were held by taut cables, they could easily be dislodged by the movements of the giant ship. But they are held, instead, by 300-ton anchor chains (strongest ever made), and their droop cushions the force of high waves and sudden gusts.

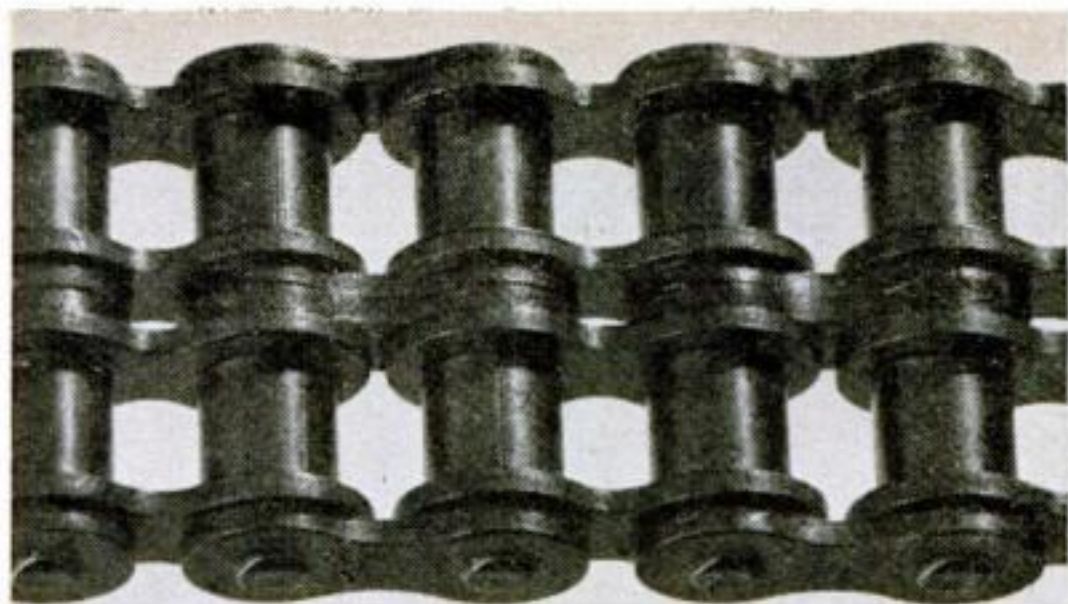
One of the most spectacular uses of "elastic," oversize chain has already saved many jet planes—and their crews. The problem: Jets that touch down at better than 100-mile-an-hour speeds



**Side plates** along banks of teeth keep narrow and moderate-width silent chains from slipping

off sprockets. In wider forms, a center guide is often used to fit slots in sprocket teeth. Size





on heavy industrial machinery. The sample shown here is a Morse two-strand chain.

can't always stop in time on rain-slick runways. The Air Force's solution: Lay hundreds of feet of heavy chain along both sides of a runway and tie the links to a fold-down nylon barrier. If a plane overshoots its safety limit, the barrier pops up and snags the plane's nose and landing gear. The chain's drag on the fast-traveling jet increases rapidly. In a matter of seconds it mounts to tons of braking force to halt the plane.

**No snag, no kink.** It is safe, too, because of a 150-year-old British invention that keeps the chain from kinking or tangling as it is drawn out. The snag-preventer consists of a separating bar across the middle of each link.

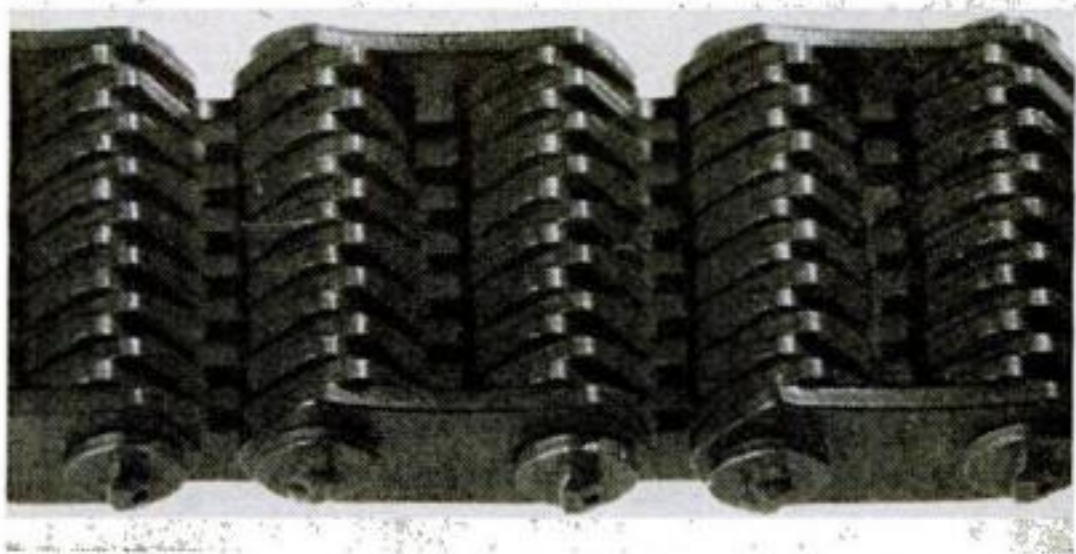
This stud link also reinforces the chain, making it the strongest type. The huskiest stud-link chains have a breaking strength of 2½ million pounds.

A string of beads. Modern chain isn't

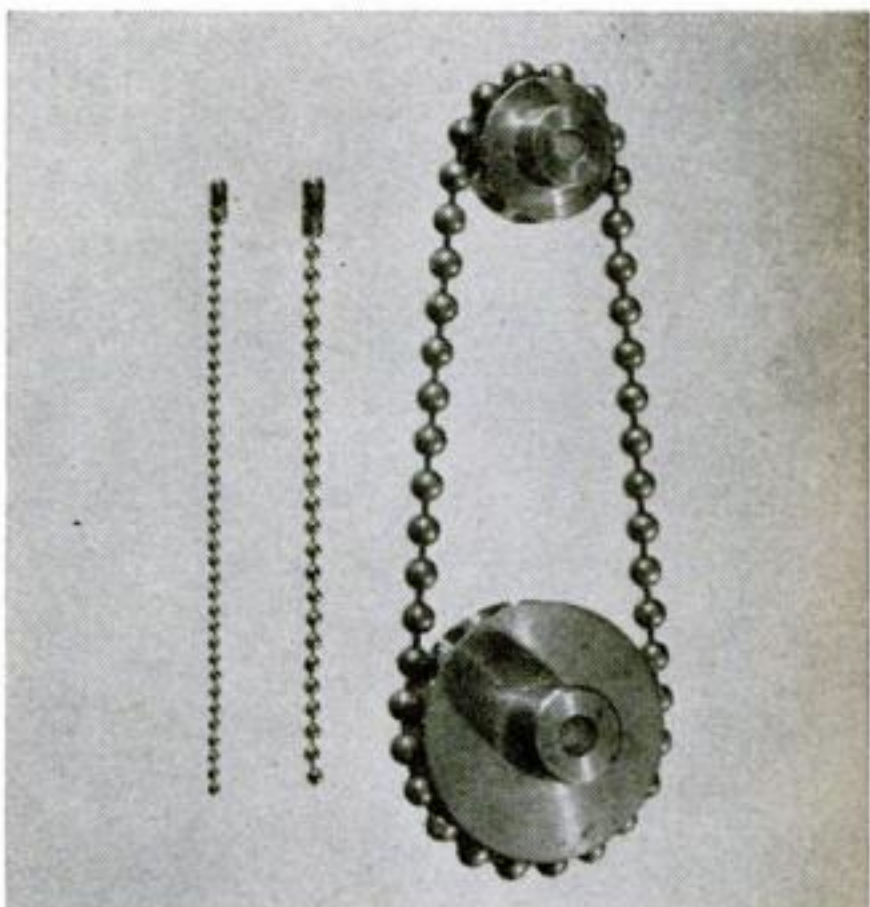
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Used for anchoring ships, Baldt stud-link chain comes in 50 regular sizes from half-inch (34,000-pound tensile strength) to 3¾-inch (rated at 1,750,000 pounds); also in special sizes for aircraft carriers and other extra-large vessels. The two sections of each link are drop-forged. Center bars prevent kinking.



range equals that of roller chain. Your automobile's timing chain costs about \$5.



Hollow-round or tubular links are joined by dumbbell-shaped interlinks to form bead chain, the most popular of all. It's commonly made in eight sizes from 3/32- to ¾-inch, which range in strength from 18 to over 185 pounds. Matching sprockets (right) allow nonslip light-duty power transmission. Bead chain is used on lights, fans, swiveling fishing lures, and as key rings. For continuous motion, the chain can be formed into an unbroken loop.



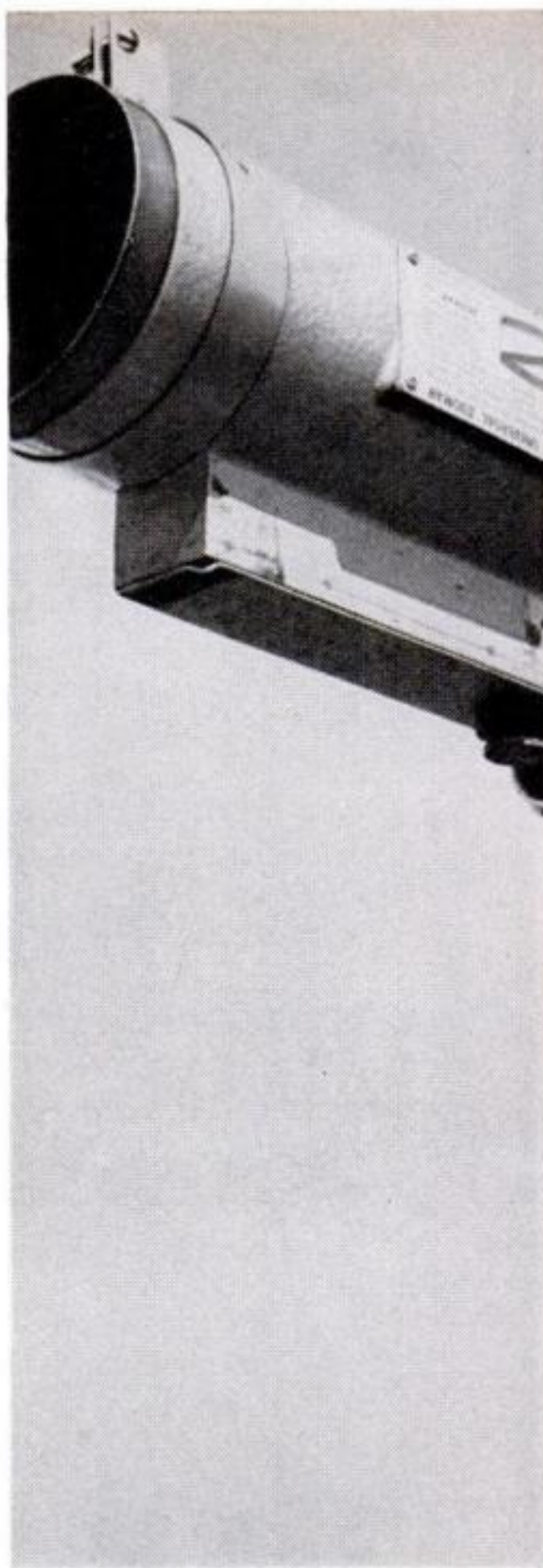
# The Other Fellow's Job

**Voice from the tower** John McNamara is 27 years old, five years out of the Navy, and he earns close to \$12,000 a year. He's worth every penny of it. In one busy hour, the lives of a couple of thousand airplane passengers depend on his sharp eyesight, clear voice, and quick judgment.

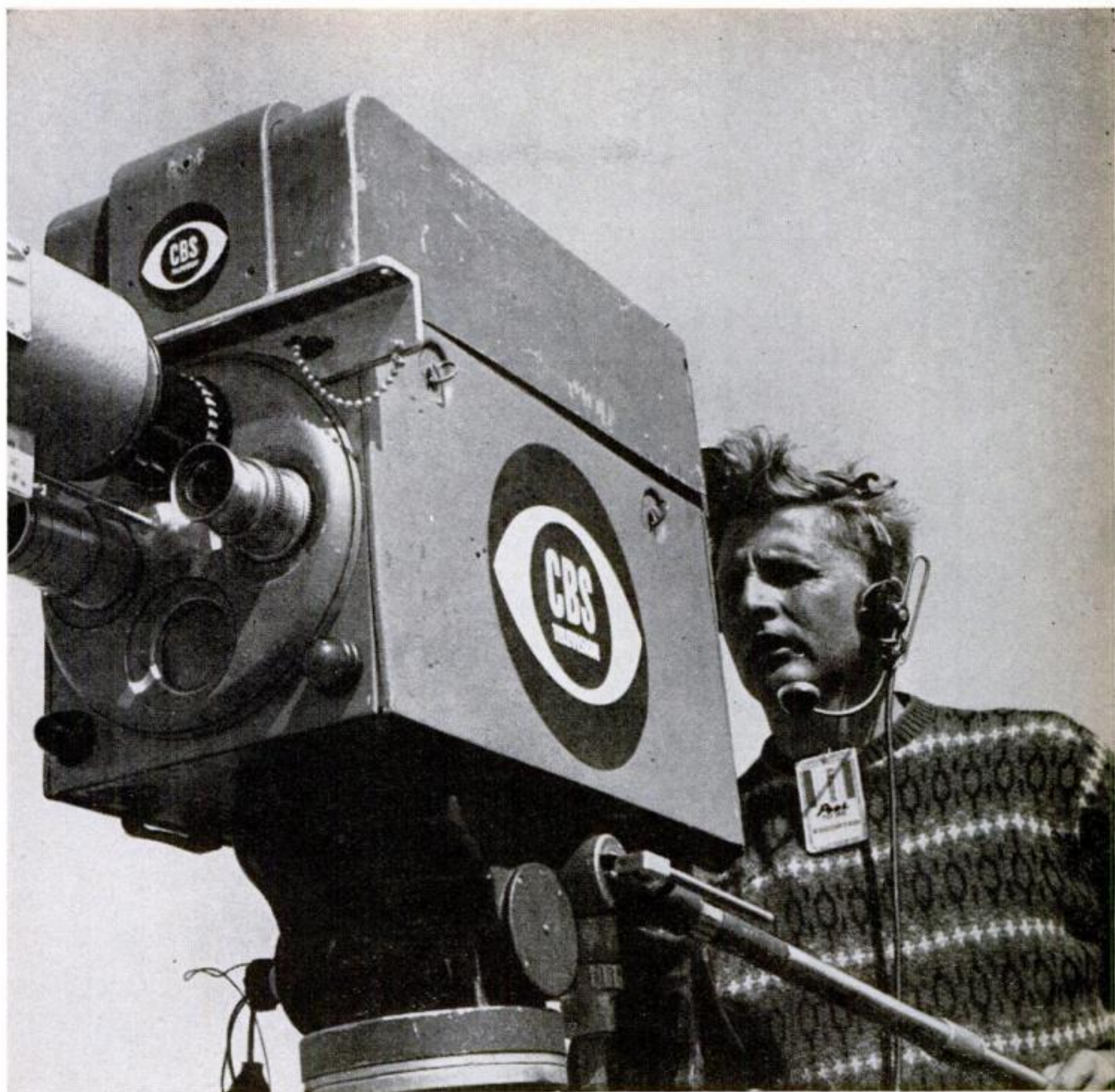
McNamara is a local controller, key man in the team that guides airplanes into and out of New York International Airport (everybody calls it Idlewild). He tells incoming planes when and where to land, outgoing planes when and how to take off.

Stand beside McNamara at the canted windows of the tower, and the job seems impossible. There's a plane every two minutes. The radio rattles out pilots' requests, often slurred by foreign accents. Traffic is mixed—an upstate farmer flying his Cub may follow a 100-passenger jet from Paris. (This really fouls up takeoffs: A slow prop plane must be allowed time to get out of the way of a jet that could overtake it in seconds. Yet the jet can't be held up long—it burns 15 gallons of fuel a minute just sitting there.)

McNamara is a native of Long Island (Southside High School, Rockville Centre). Like most controllers, he learned his job in service (Norfolk Naval Air Station). He went through the Federal Aviation Agency course at Oklahoma City before starting as an assistant controller.







## Man behind the lens

When Pat McBride first focused a TV camera, the audience totaled a few hundred people and the programs (badminton games and amateur prize fights) totaled 1½ hours a week. That was 1941. Now Old-Pro McBride is chief cameraman on the Columbia Broadcasting System's choice shows—special dramas and musicals, the astronaut launchings (that's a Cape Canaveral identification badge clipped to his sweater).

This job requires both artistic sense and technical skill. McBride works out angles and composition with the director, but is totally responsible for adjustment and

movement of the big, complex camera. "I get so involved sometimes I feel I'm in front of, instead of behind, the camera," he says.

McBride, oddly, prepared for the priesthood (St. Charles College). But work on documentary movies in school lured him to the then-struggling television industry.

Today, competition for jobs in TV is very stiff (the work is glamorous and sometimes pays exceedingly well). Cameramen, after three years' apprenticeship, are paid a minimum of about \$200 a week as regular salaried members of the CBS staff. Top men like McBride, of course, get much more than the minimum.

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## Brake fixer

Relining brakes isn't all that Bernie Stoner does, but it is the specialty of the house. Stoner is a lead mechanic for the Tilden chain of repair shops, which limits its work to running gear—brakes, suspensions, steering mechanisms. He can finish a complete relining job in less than an hour (a team of four Tilden hands once did it in seven minutes to win a contest).

Stoner is the clean-uniformed, greasy-handed guy in the Newark, N.J., shop who waves the customer onto a specially designed rack. It has electrically driven rollers that the car wheels work against. Servos relay the retarding effort to dials (at left, out of photo). This measures the effectiveness of each brake, but it's intended mainly to impress the customer. Stoner pulls a wheel anyway, and checks the drum and lining with his expert hands.

Auto mechanics are in demand these days. The Tilden firm hires young men straight out of high school as \$55-a-week "band boys," but prefers those with vocational training or experience (and pays them more). Stoner is exceptionally qualified. He started as a helper at 14, while still at West Moreland High School (near Wilkes Barre, Pa.). He attended Penn State, quit to work in a garage, then operated his own service station before joining Tilden. He now gets \$7,000 a year. ■ ■



As fast-steering and damage-proof  
as an outboard, as quiet  
and powerful as an inboard

What's inside  
those new

# Inboard-Outboards

By George Daniels

**W**HY the big boom in inboard-outboards? Lovers of the new crossbreed have an easy answer: It can do everything either of its parents can do—plus a lot of things they can't do. Result: Buyers are standing in line, and more than a dozen top manufacturers are busy turning them out.

"We didn't realize we were starting a landslide," said Ken Spurgeon, president of Muncie Gear Works. Muncie gave the first shove at

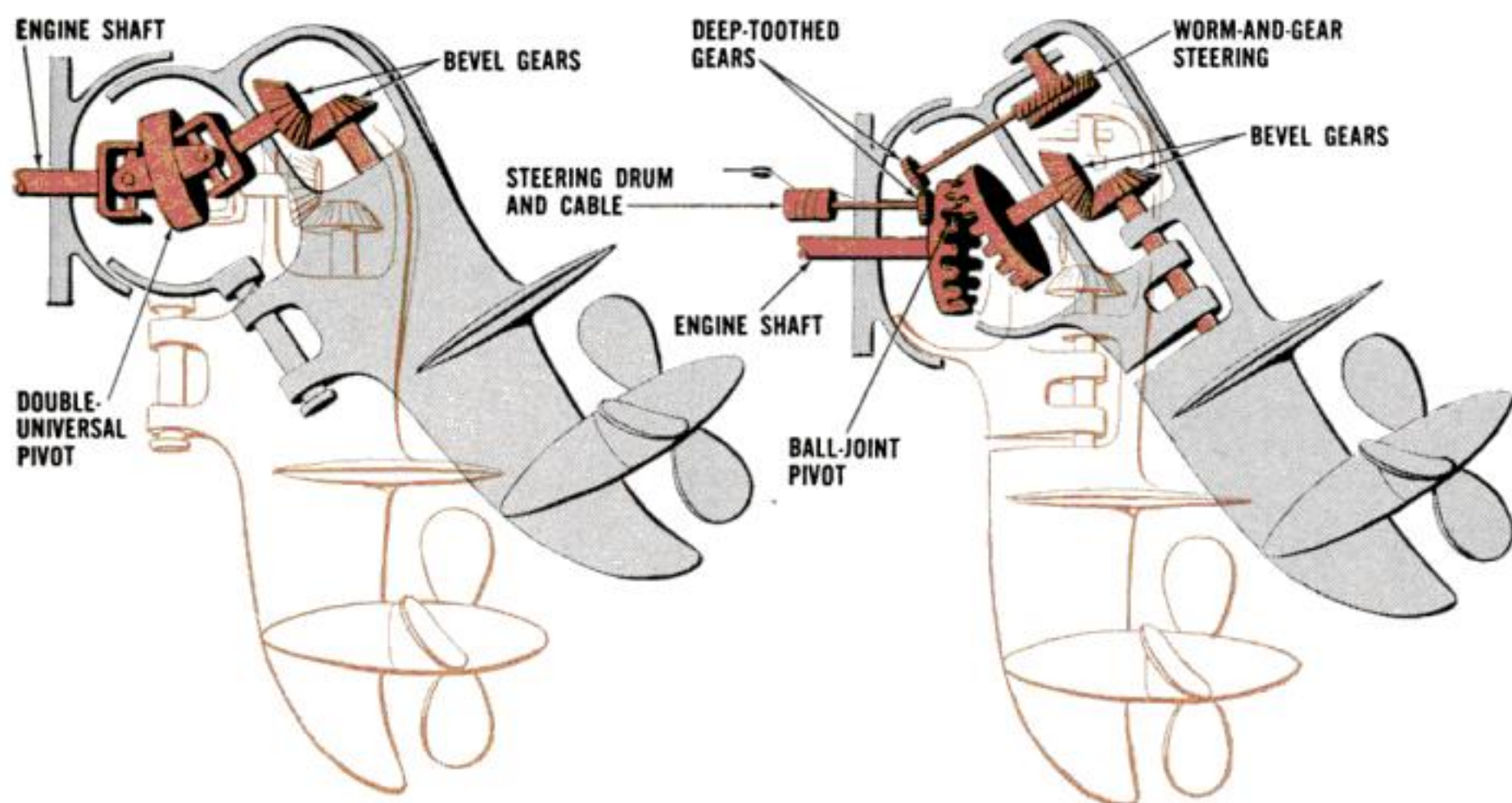
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Protection from impact damage is afforded by kick-up feature. Volvo demonstrated this by racing a boat across sand bars without damage.





## Clever engineering directs power around two corners, in ways



### Universal-joint tilt

In universal-joint-tilt outdrives, steering and tilting pivots are both aligned with center of universal so that both get maximum flexibility. Bevel gears aft of universal transmit power to the vertical drive shaft and, through a second set of bevel gears, to the prop. Sixty-degree sideward swing is ample because of the added zing given by prop-thrust steering.

### Ball-gear tilt

Ball-gear pivot acts as a locked, straight-through coupling in drive position. When drive unit tilts, ball-gear teeth still mesh at top and act as variable-angle bevel gears. Aft section of the drive unit pivots on bearings around vertical drive shaft for steering. Deep-toothed gears at side of the pivot point keep steering train in mesh even during kick-up.

Chicago's 1956 boat show with their new Flexidrive. The long-forgotten hybrid power system caught on with a bang and hasn't tapered off since.

The I/O (its nickname) costs a lot more than an inboard or outboard of comparable power. And it isn't likely to become much cheaper in the near future. It's a more complex piece of machinery. Why the popularity then?

For one thing, the I/O is more efficient than an inboard. The propeller pushes straight ahead instead of upward at the inboard shaft angle. And the drag of struts and other underwater bric-a-brac is gone. The same power in an I/O nets 10-25 percent more speed.

The biggest outboard engine available today puts out 100 hp. But some I/Os boast more than 300 hp.

And the I/O offers all the benefits of an outboard: protective drive kick-up if

you hit something; prop-thrust steering that turns your boat when you turn the wheel, not some time later; easy prop repairs without hauling (all I/O props can be tilted to the surface).

On the Eaton Powernaut, Mercruise II, and several others, you can also swing up the drive laterally until the prop points skyward right behind the transom—handier for repairs than some workbenches. To spare your muscles, others offer electric crank-up.

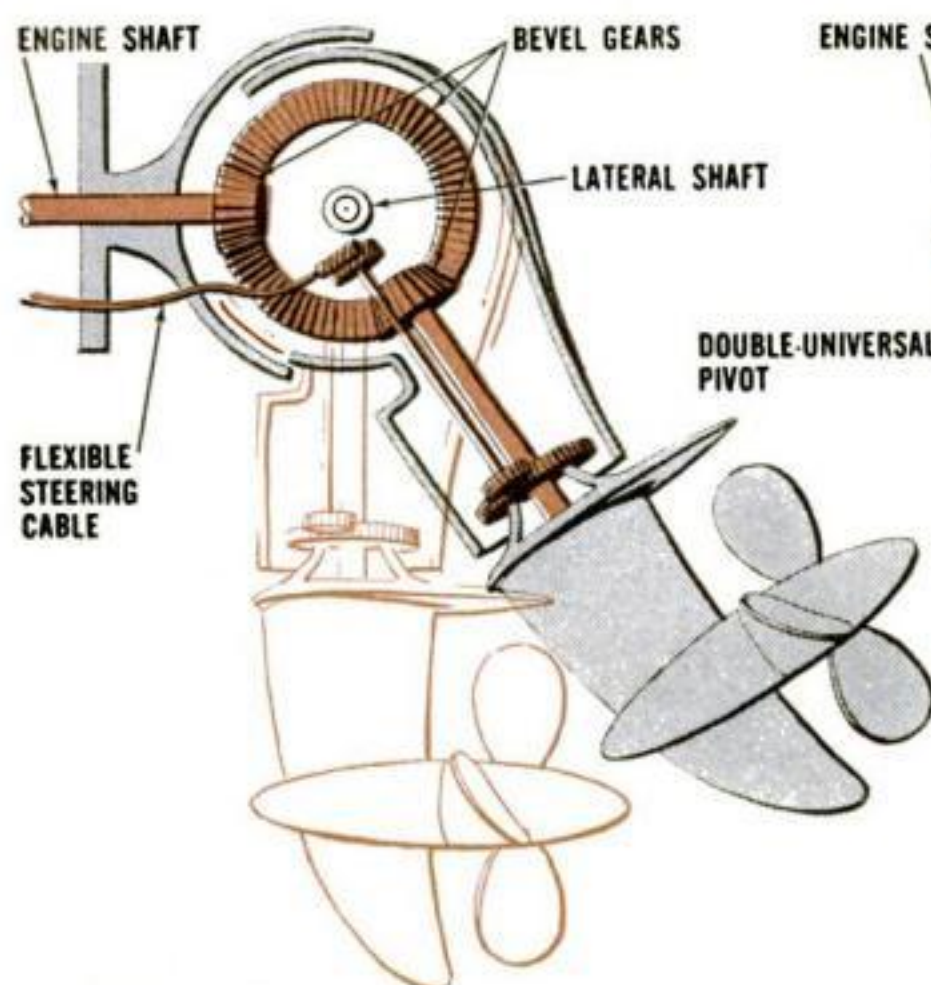
A tilted I/O is as easy to trail as an outboard. And if you prefer to leave it at the mooring, it's more theftproof. Flip a lever on the Powernaut or pull a pin on Brennan's Imp, and take home the entire drive unit. It's not easy to pirate a boat with no prop or rudder.

The engine is safer from thieves, too. It's mounted inside the boat.

On some packages, the engine can be

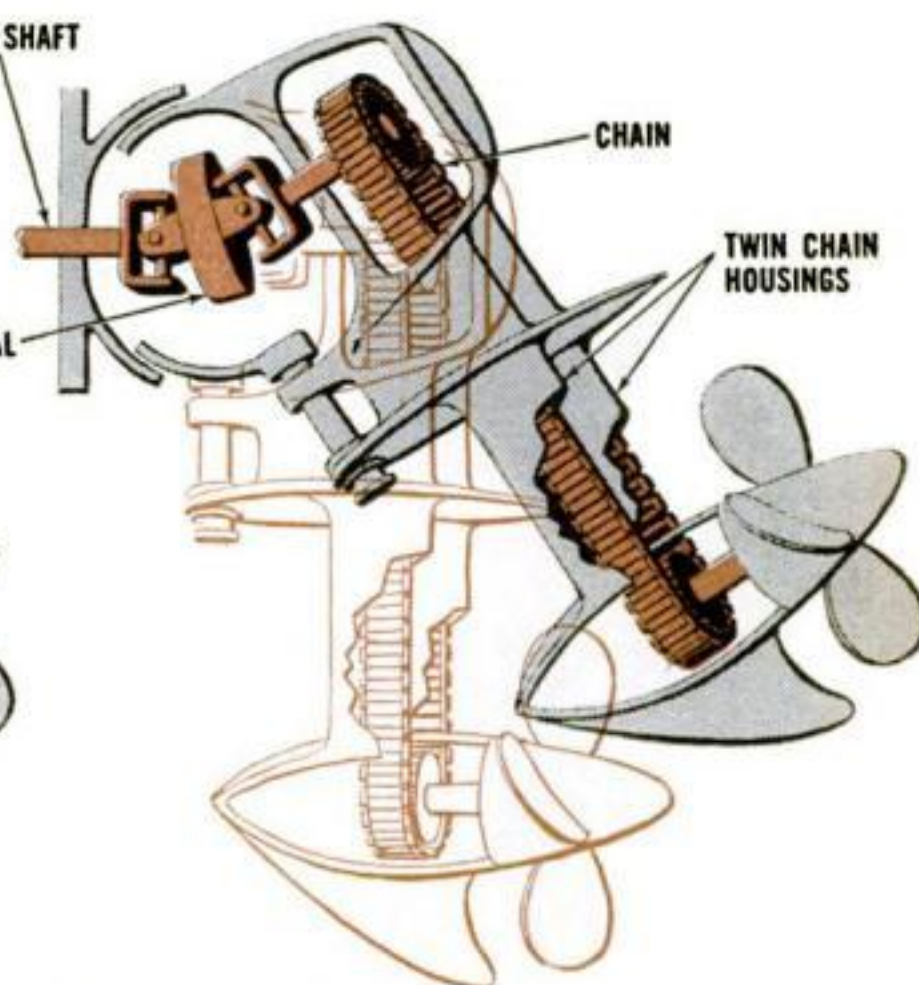


that still allow both tilting and swiveling of the prop at the end



### Full-bevel gear

Full-bevel-gear drive consists of horizontal shaft from the engine ending in a bevel gear that meshes with a bevel gear on a lateral shaft. Vertical drive shaft also has a bevel gear that meshes with the lateral-shaft gear. Vertical-shaft gear rolls up the lateral-shaft gear for tilting. Full-circle steering permits reversing of the propeller to tractor position.



### Universal joint and chain

Unusual Morse silent-chain drive is found only on the Harnischfeger Power Hawk. Chain runs down one vertical strut and up another; both struts are watertight. This setup, similar to experimental one tried briefly in the 1930s, eliminates need for bevel gears. Steering and tilting are accomplished through a conventional double-universal joint.

mounted in several positions. Kiekhaefer's Mercruiser offers extension drive shafts of two, three, and four feet to make it easy. And Brennan Mfg. Co. reports many sales to owners of old inboards who leave the engine where it is and reshaft for the new Imp stern drive.

**A peek inside the drive units.** Several basic types of power transmission are used in current I/Os. The most common one (on Volvo, Merc, and most others) consists of a double universal in the horizontal drive shaft. OMC uses a simple but seldom-seen ball gear instead of a universal. The Morse silent-chain drive has been revived in the new Harnischfeger Power Hawk and is used along with double universals.

The acrobat of them all is the full-bevel-gear setup, with 360-degree steering. It's the only drive that can go forward in reverse and vice versa.

Examples of this system are the Seapower Drive by Western Gear Corp. and the Brennan Imp unit.

**Steering on I/Os** is via either conventional pulley and cable (or rope) or the newer push-pull cable such as Kiekhaefer's Ride-Guide, which works like an overgrown auto-choke cable.

Stern units with worm-and-gear steering are drum-operated and require a cable and pulley. With tiller or lever steering, you can take your choice.

A point in favor of push-pull: It runs along only one side of the boat and, since it need not be taut like a cable, can be led around obstacles. A pinion on the steering wheel moves a toothed rack in either direction and slides the steering cable inside its plastic-and-metal sheath. At the drive end, the cable is attached to the tiller.

**I/O power plants.** What kind of en-



## Not every maker will sell you an I/O. Reason: a bungled

gines are coupled to these stern drives? You have your choice of marine two- and four-cycles for about \$1,500 and up. Mercedes-Benz diesels (35 and 100 hp.) with Mercruiser drive sell for \$2,500-\$4,500. For about \$2,000 you can get a 150-hp. auto-conversion with outdrive. A 310-hp. V-8 is available with Mercruiser drive for about \$2,950.

Among the more unusual engines is OMC's 80-hp. two-cycle V-4 FI 90, the first two-cycle I/O with both oil injection and fuel injection. And West Bend's 80-hp. in-line four. Basically, it's the West Bend outboard, but tipped from vertical to horizontal. Separate coil, condenser, and breaker point for each cylinder give killproof ignition that permits extended runs on two cylinders.

**Latest I/O improvements.** A heat exchanger is available on some of this year's engines. It's standard equipment, for example, on the Palmer 150-hp. Buick aluminum V-8 conversion with Flexidrive (about \$2,000).

With this setup, only fresh water or

permanent coolant circulates through the engine block. It also circulates through a heat exchanger built into the engine, where it's cooled by sea water pumped through the exchanger tubes.

If the sea-water tubes should cake or clog, their straight form and removable caps let you clean them ram-rod style, like a rifle. There's no worry about corrosive caking or clogging of the engine block; sea water never touches it.

Features seen on a few models a year ago and now available on many are kick-up shock absorbers and automatic ignition cutoff during tilting. Slow-motion films made by Mercury show how important they are.

With no shocks or ignition cutoff, the drive unit is kicked up in a high-speed impact, banging the top of the transom inward. Meanwhile, the prop, clear of the water, nearly doubles its speed.

When it bounces back into the water, it bites in with a momentum that slams it back to drive position with a triphammer wallop. This can rip the transom

DRIVE UNIT	MANUFACTURER	HORSEPOWER	WEIGHT OF ENGINE AND DRIVE UNIT (pounds)
BRENNAN IMP	Brennan Motor Mfg. Co. Syracuse, N. Y.	40	175-225
FLEXIDRIVE	Muncie Gear Works Muncie, Ind.	80-155	517-718
INTERCEPTOR	Eaton Mfg. Co. Madison Hts., Mich.	85-120	440-550
MERCRUISER	Kiekhaefer Corp. Fond du Lac, Wis.	110-310	Not available
OMC DELUXE 17	Outboard Marine Corp. Waukegan, Ill.	80	285
POWER HAWK	Harnischfeger Corp. Crystal Lake, Ill.	Takes gas or diesel engines 90-135 hp.	Drive unit only, 125; complete with 135-hp. V-4 engine, 1,060
SEAPOWDER DRIVE	Western Gear Corp., Houston, Tex. (Distributed by Northwest Engine and Marine Co., Portland, Ore.)	Takes engines to 170 hp.	Drive unit only, 87
SHARK-O-MATIC 800	West Bend Co. Hartford, Wis.	80	235
VOLVO PENTA AQUAMATIC	Volvo Import, Inc. Englewood Cliffs, N. J.	80-100	440-460



## installation is bad advertising

outward at the top. But on new models, the cutoff switch kills the r.p.m. build-up, and the shocks cushion the return (but not kick-up).

**Shopping for an I/O.** Before you rush to your nearest dealer to buy, be warned that you may encounter complications.

Some makers sell only to boat manufacturers. OMC's FI 90 is available only with the company's fiber-glass runabout, though the carburetor version is available to other builders. Volvo and some others sell through franchised dealers, but frown on unchecked sales to do-it-yourselfers. I/O installation is exacting, and a bungled job is bad advertising, no matter who goofs.

On the other side of the fence are makers such as Brennan Motor Mfg. Co., which sells its Imp, with or without its 40-hp. motor, to anyone. So far, they haven't encountered any headaches.

If you know boatwork and want to do your own installation of an I/O (one that isn't bound to a special sales policy), you can get what you want. ■ ■

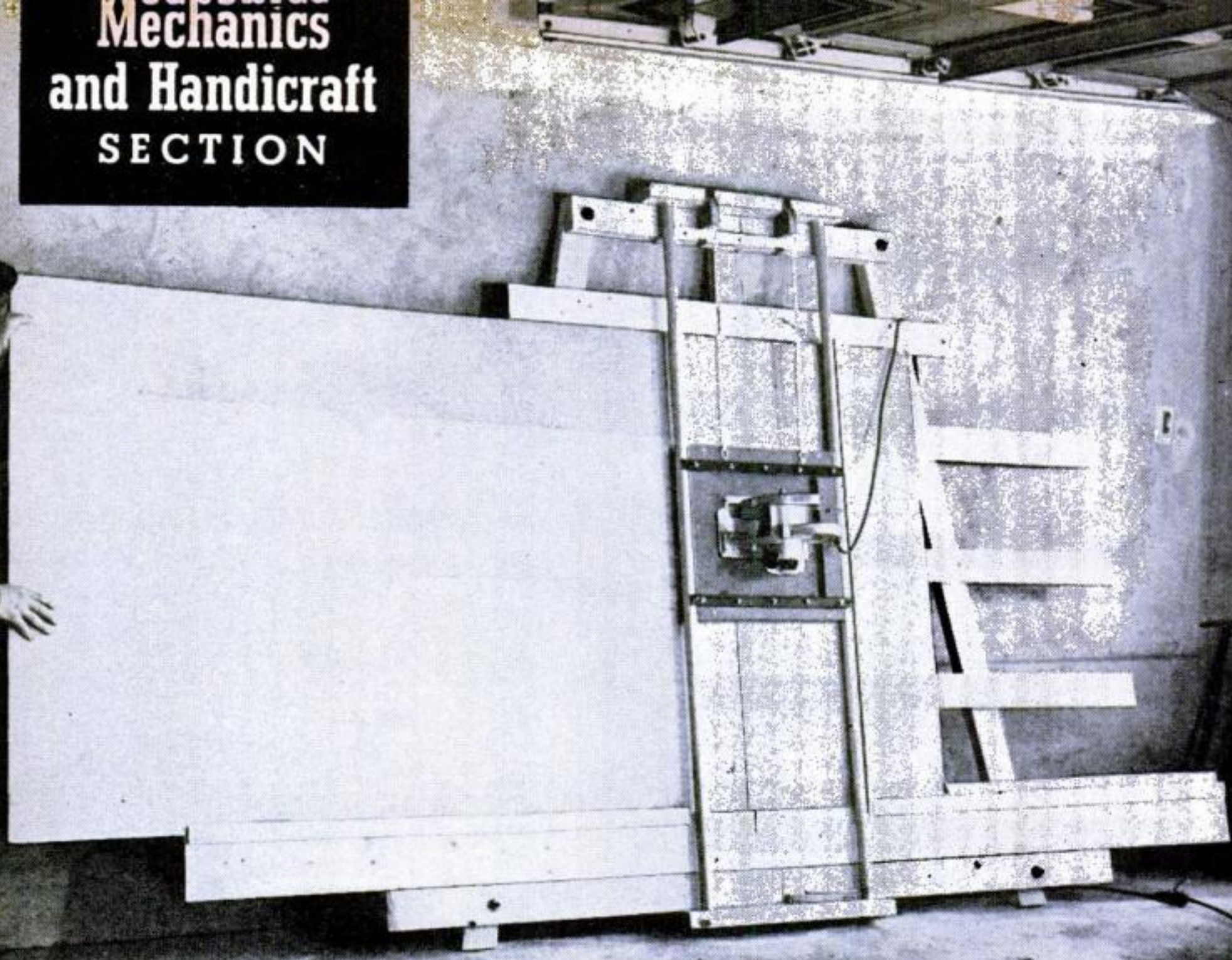


Electrically operated lateral crank-up on the big Mercruiser II drive unit swings the prop straight up out of the water within easy working reach of the cockpit or after deck.

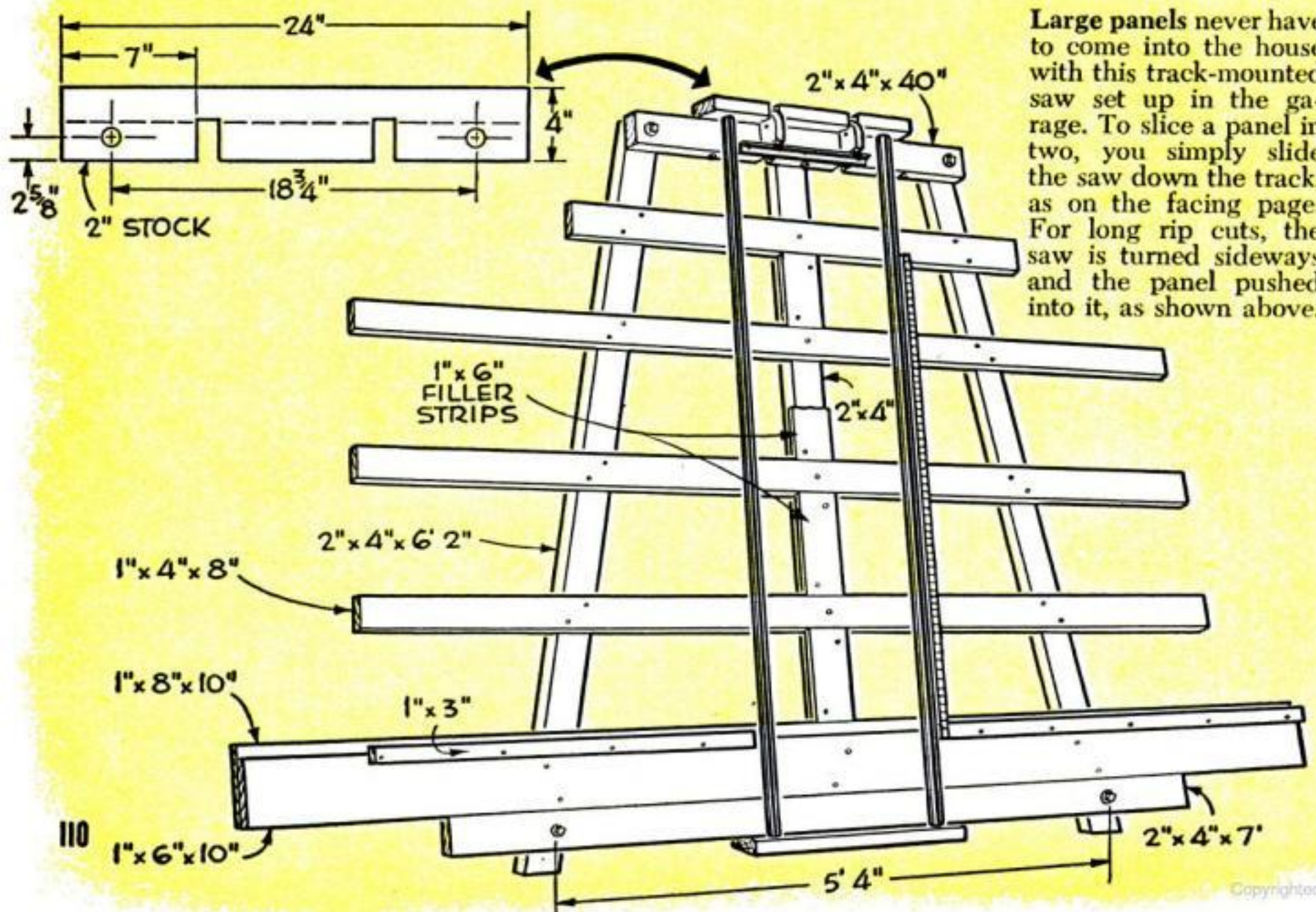
REMARKS	PRICE
360-degree steering; new drive unit takes up to 200 hp.	\$495 for drive unit only; \$1,295 complete
Uses auto-engine conversions	\$700 for drive unit only; \$1,500-\$2,165 complete
Two six-cylinder engines and a V-8 available	\$1,485-\$1,745 complete
Also available with 35-100-hp. Mercedes-Benz diesels (about \$2,500-\$4,300); 330-hp. Boeing gas turbine available on special order	\$1,680 to about \$3,000 complete
Fuel-injected engine available only with OMC boat; engine without fuel injection available for other boats	\$3,500 complete, with boat
Silent-chain drive; has 90-degree steering, 50-degree tilt	\$675 for drive unit without gear shift; \$895 with gear shift; \$3,948 with 135-hp. V-4
Has 360-degree steering, 90-degree tilt; uses auto-engine conversions	\$595 for drive unit only
Two-cycle engine	\$1,395 complete
4-cylinder auto-engine conversion	\$1,450-\$1,650 complete



# Mechanics and Handicraft SECTION

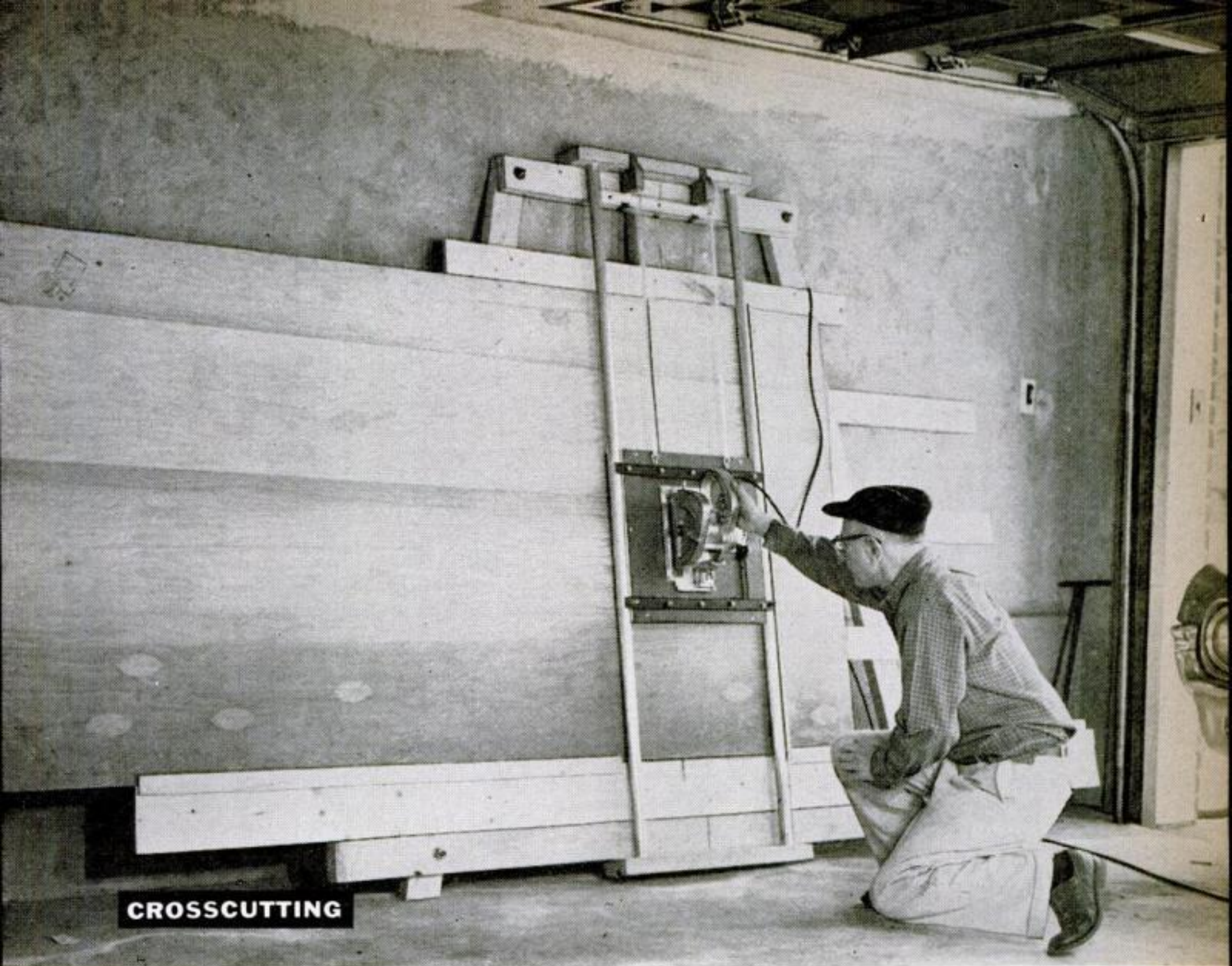


**RIPPING**



Large panels never have to come into the house with this track-mounted saw set up in the garage. To slice a panel in two, you simply slide the saw down the track, as on the facing page. For long rip cuts, the saw is turned sideways and the panel pushed into it, as shown above.





**CROSSCUTTING**

Here's how you can turn a portable circular saw into—

# A Homemade Saw for Cutting Big Panels

By Ralph Treves

**A**NYONE who has ever horsed a heavy plywood panel down the cellar and through a saw has probably cast an envious eye at the track-mounted panel saws that lumberyards use to slice up big sheets. With an easy-to-make jig, you can

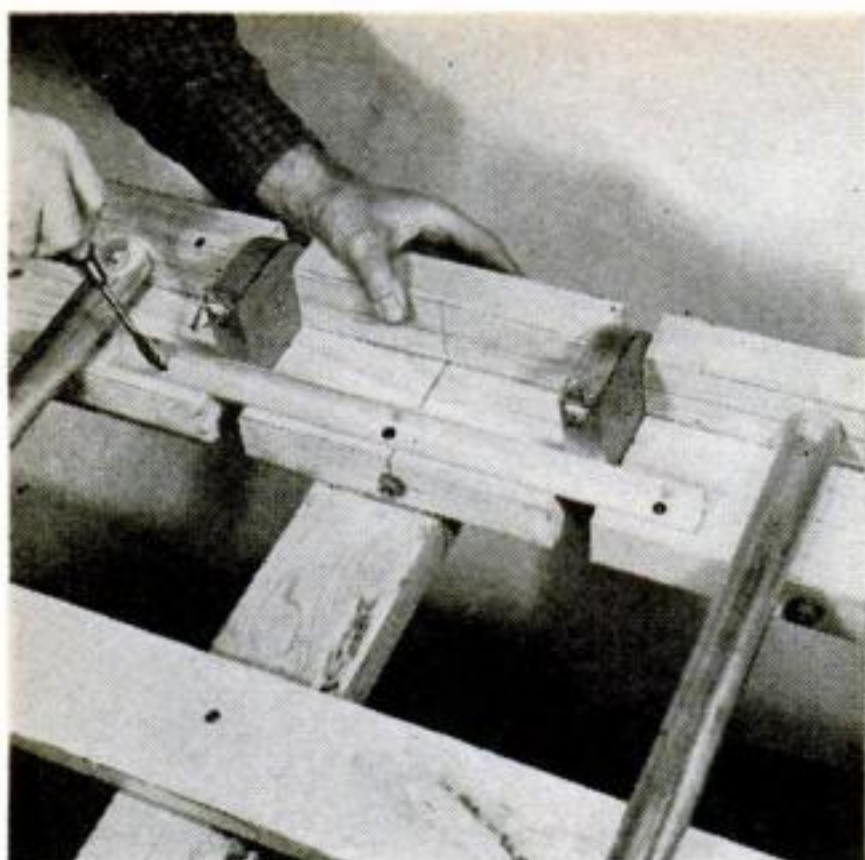
turn a portable circular saw into a panel saw that will do similar jobs in your own home.

The panel-cutting jig is a simple A-frame stand that leans against a wall. It holds any make of portable saw in a vertical track. Slide the saw down and it slices a panel in a single stroke. Turn the saw sideways

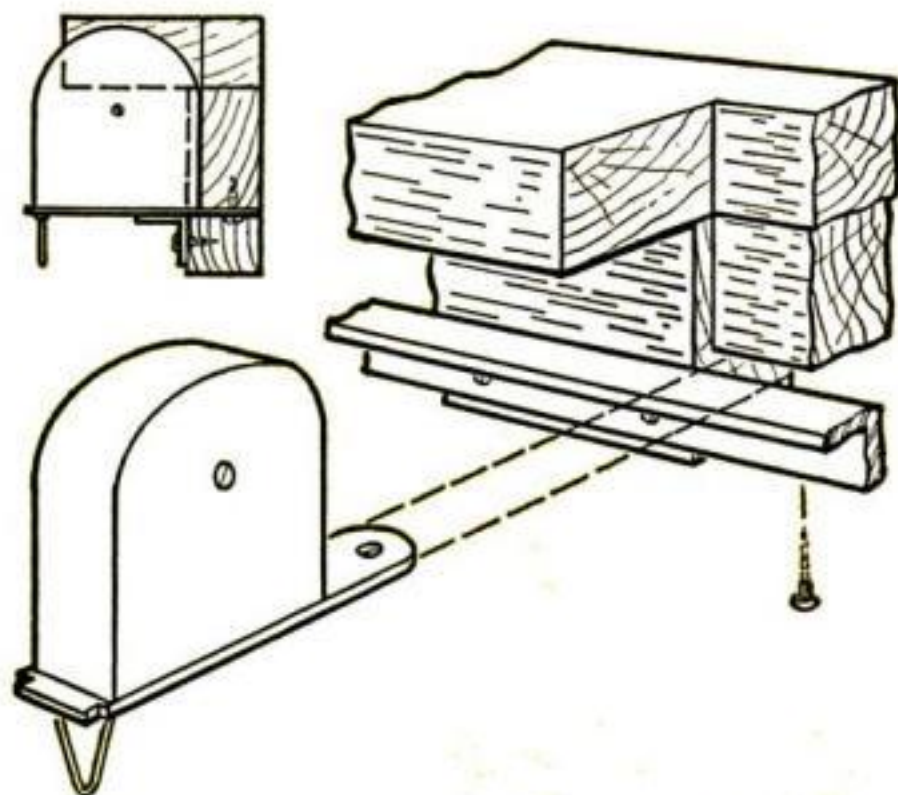
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III





**Spring-type sash balances** support saw's weight, are notched into track's top rails as shown in



sketch. For added strength, aluminum-angle brace is screwed under the balances.

in the track and you can rip panels to their full length by feeding them into the blade lengthwise. There's no fussing with the cumbersome outrigger supports that you need with a table saw to handle big sheets.

The jig can be set up anywhere. My own favorite spot is along a garage wall. This way, big sheets are brought in the driveway and cut right on the spot into small, easily handled pieces before you lug them indoors. You don't have to struggle with those sharp turns and stairways that are murder with a hefty four-by-eight-footer.

There's less waste, too, because you don't go chopping up full sheets willy-nilly just to get them to manageable size. You cut off only what you need when you need it. Besides plywood, the saw is ideal for hardboard, plastic laminates, and other large sheet materials.

**How the saw works.** The portable saw is mounted in a plywood frame that rides up and down a track made of two 1½"-diameter aluminum tubes. The tubes are the Reynolds type readily available at hardware stores. The saw's weight is completely supported by two spring-type window-sash balances fastened to the top of the jig. It takes only a light touch to slide the saw up or down.

For accurate cuts, well-seasoned lumber is recommended for the basic jig members to avoid shrinkage and warpage that might distort the frame. The track tubes must be parallel to each other and square to the lower rail that supports the panels. Note,

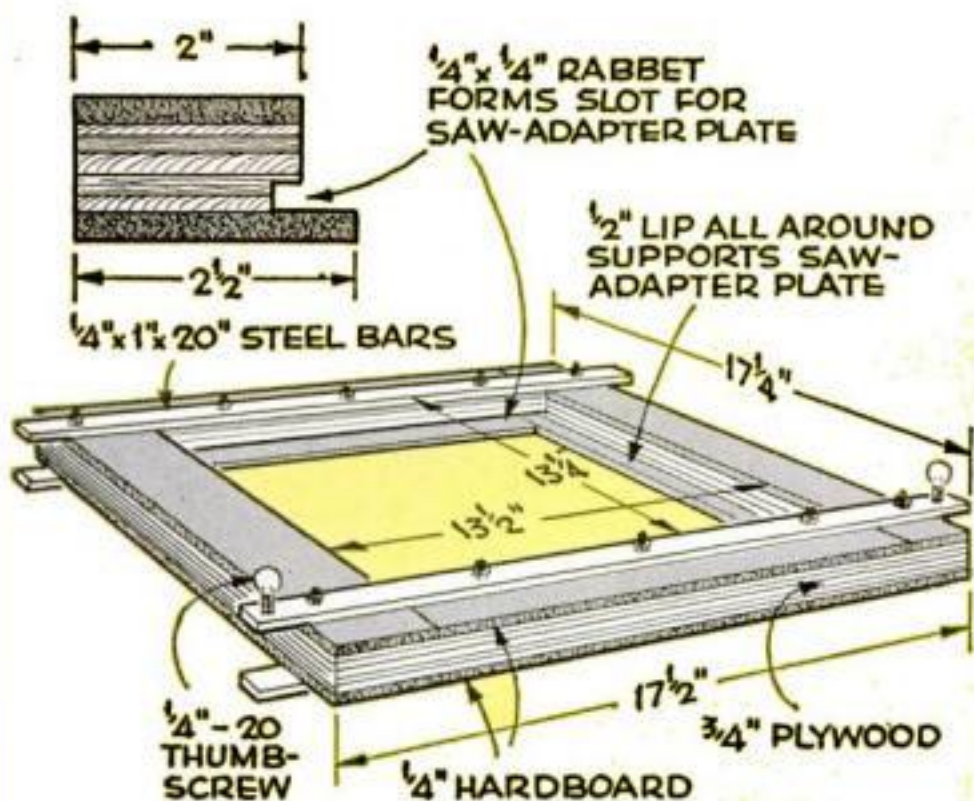
too, that clearance between the track and the frame is fairly critical. You need 1½" to allow for the thickness of the panels and the guide bars on the back of the saw slide. But any more than this will sacrifice valuable blade depth.

The easiest way is to make up the track as a separate unit first, carefully lining up the holes for the aluminum tubing by clamping the top and bottom cleats together and drilling both simultaneously. The cleats are lengths of two-by-six stock ripped down to a 4" width. The tubes should be a tight fit in the cleat holes to avoid side play; they will need no fastening. Track length has been designed to take advantage of standard 6' tubing lengths.

**Setting the track square.** Bolt the top of the track in place first, leaving the lower end temporarily free. It can be shifted slightly from side to side as needed to square the track to the frame.

For a quick job, you can use a large carpenter's framing square or slip in a panel of plywood and use its edge as a guide. For more precise alignment, carefully level the rail on which the panels rest and drop a plumb line from the top to show where the lower track end should go. In any case, temporarily clamp or nail the lower end and check a trial cut for squareness before fastening it permanently. It's also wise to check the jig from time to time to detect any seasonal changes in moisture that might throw it out of square. Slight adjustments





Saw's adapter plate, 13½" square, fits into the slide in any position so saw can be turned ver-

can be made as needed by loosening the bolts at the top and tapping the track a bit to one side or the other.

**Making the slide.** This is a frame of ¾" plywood with a rectangular cutout in the center for the saw. It should be cut to a precise fit between the track tubes after the track has been mounted.

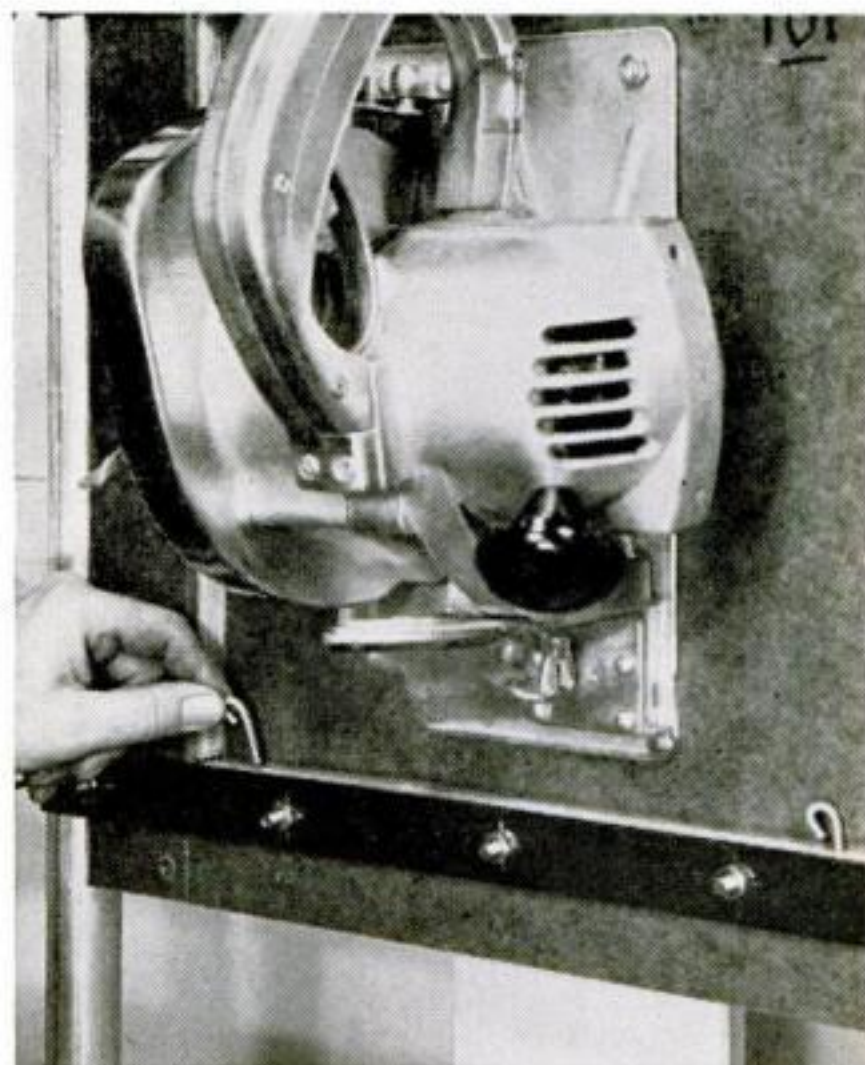
Strips of ¼" hardboard are added to both sides of the plywood slide to bring its total thickness to 1¼"—matching the 1¼" diameter of the aluminum-tubing track. The rear hardboard strips overhang the slide's cutout to form a small lip all around the opening. The saw's base shoe is bolted to an adapter plate of ¼" hardboard, and this rests against the lip inside the slide.

A ¼"-by-¼" rabbet is also cut in the back of the slide at the top of the cutout. When this is covered by the overlapping hardboard strip, it forms a slot. The saw's adapter plate is hooked into this slot to hold it at the top. Two removable metal pins then lock it in securely at the bottom. The saw's adapter plate, being square, fits into the slide in any position. To switch from crosscuts to rip cuts, you simply remove the saw, turn it sideways, and slip it back into the slide.

The slide is held in the track by two pairs of ¼" steel bars bolted to the front and back. These form U-shaped brackets at the sides that straddle the aluminum tubes. If their fit is too snug, file them lightly where they bear against the tubes. To lock the slide in the track, the ends of



tical or horizontal. Upper edge hooks into slot formed by ¼" rabbet in top of the slide.



**Removable pins** lock the lower edge of the saw's adapter plate into the slide. Note that bolts in the slide face outward, with heads on the other side. Use flathead type, countersunk flush in the rear crossbars so that their heads won't interfere with panels being cut.

one crossbar are drilled and tapped for ¼"-20 thumbscrews. Tightened against the tubes, these hold the saw at any height.

For extra-smooth sliding, the edges of the slide can be covered with scrap strips of plastic counter laminate, cemented on.

[\[Continued on page 190\]](#)





For use on the workbench, place the furnace on a brick platform. A screwdriver run through the eyebolts makes a cool handle for the hot lid.

Crucible of molten metal is lifted out the top, using pliers as tongs. The one below holds seven fluid ounces of white metal for model castings.



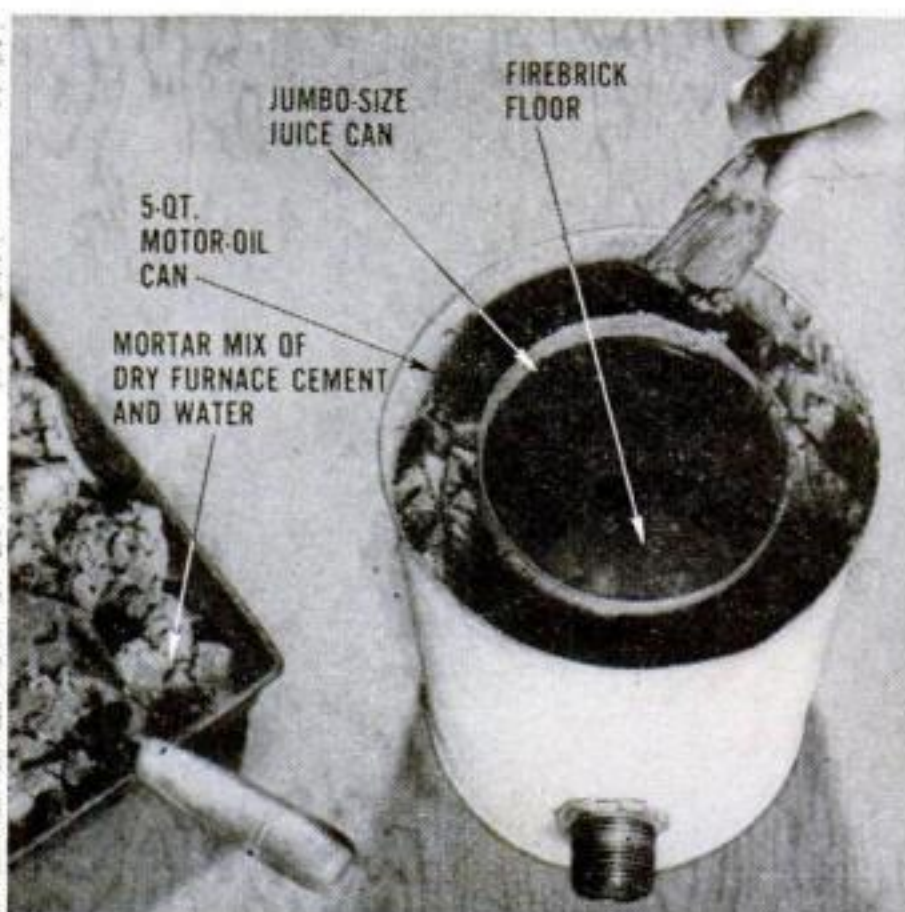
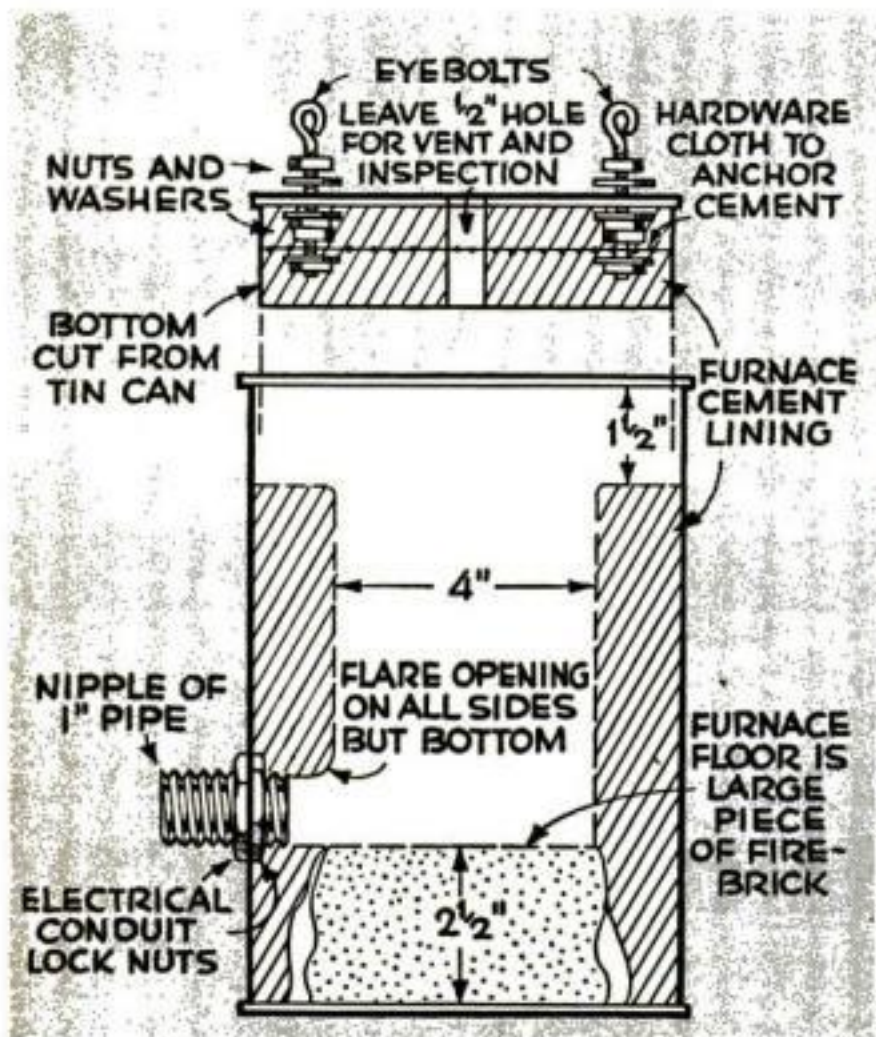
## Blowtorch Foundry Furnace

**T**HIS homemade accessory lets you produce small castings of soft metals, such as common aluminum and lead. If your torch isn't the two-piece type shown, block up either furnace or torch to bring the firing port and burner nozzle into line. Melt the metal in a crucible, a stainless-steel measuring cup, or even a tin can.

Materials for the furnace won't cost over \$3. Most of them are scrap. Wash the oil

can thoroughly with detergent; any oil film will keep the lining from bonding. When the cement is firm (but not fully set) poke a dowel through the pipe nipple to pierce the lining. Remove the juice can with a gentle twist.

A gasoline torch is most economical, but a propane torch will keep the furnace at high heat for nearly three hours on a tank of fuel.—*M. Steele.*



Snip off the bottom of inner can above bead and grease can for easy removal. Place it on the firebrick and tamp cement in thoroughly.



Money-saving tricks for

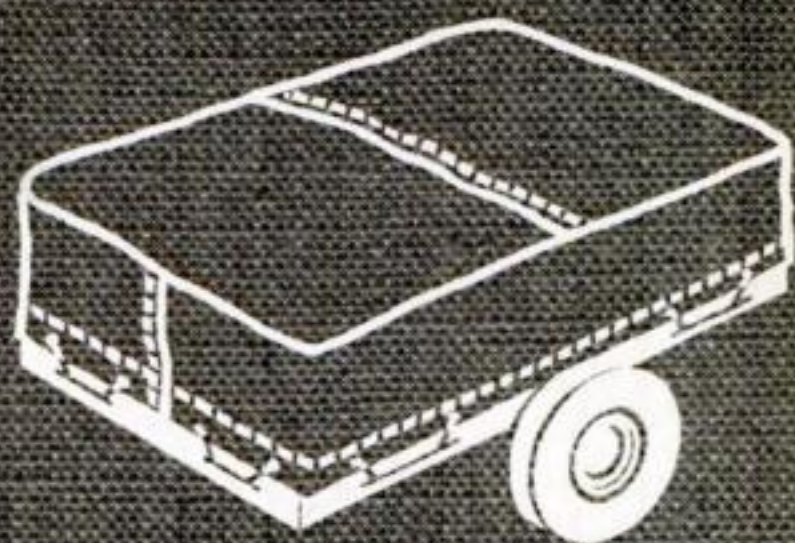
# Working with Canvas

**O**NE of the most versatile, inexpensive—and neglected—materials around is canvas. If you confidently rip into expensive plywood but shy away from scissor-and-thread projects, you're missing a lot of chances to save money.

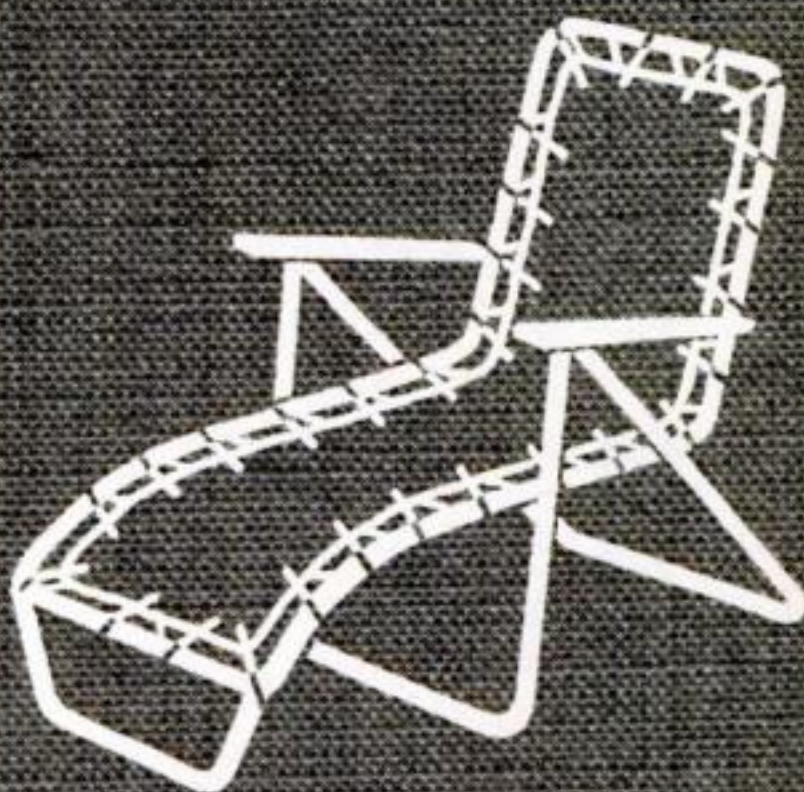
There's nothing mysterious about success in working with canvas and similar materials. It's almost foolproof once you've learned the basic techniques.

You can turn out the equal of a \$75 boat or trailer cover for about \$25; save at least half on awnings and porch curtains; rescue rickety deck chairs for a few pennies; combine canvas with rigid structural materials

CONTINUED



MAKE A TRAILER COVER



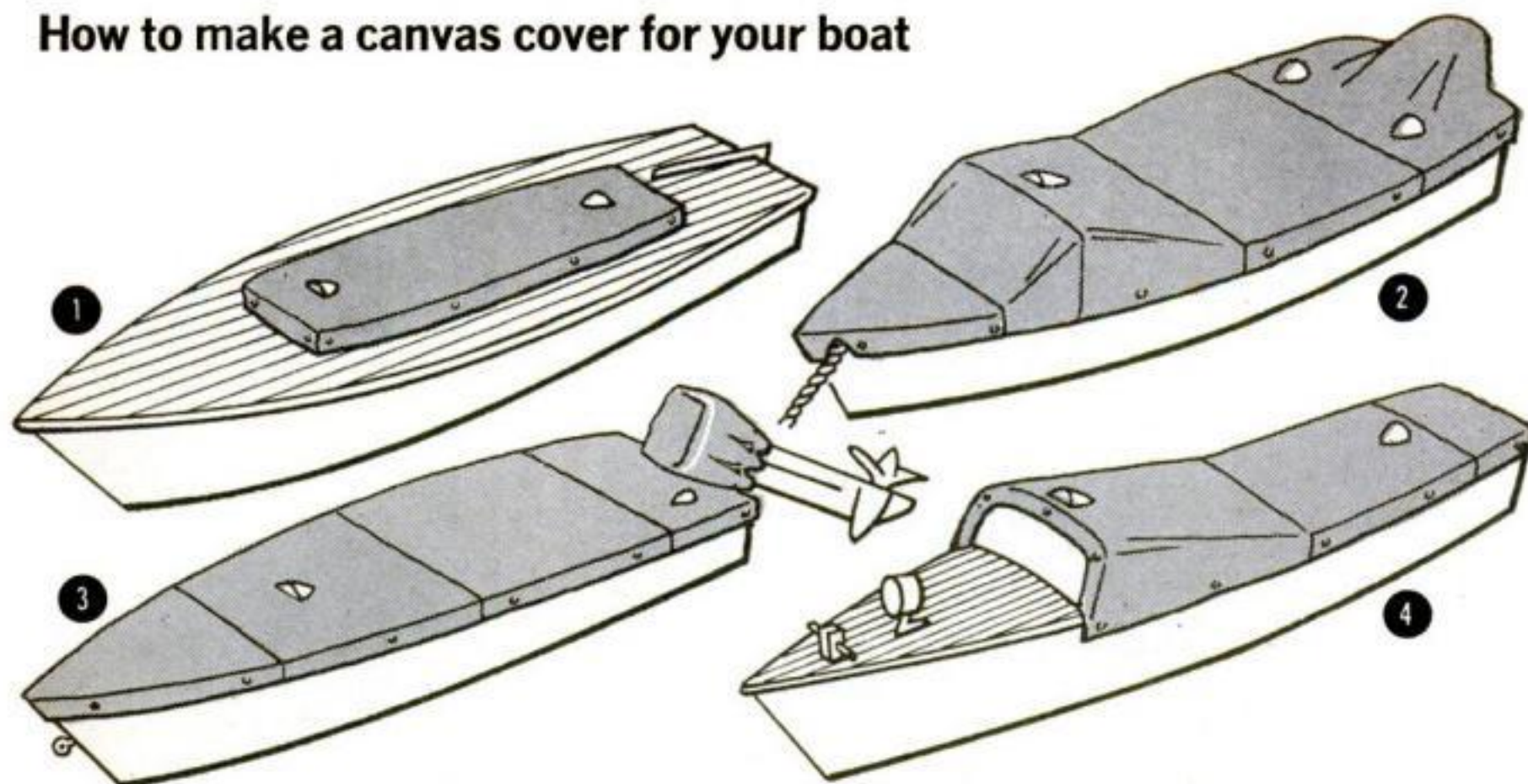
RENEW LAWN CHAIRS

MAKE A BOAT COVER





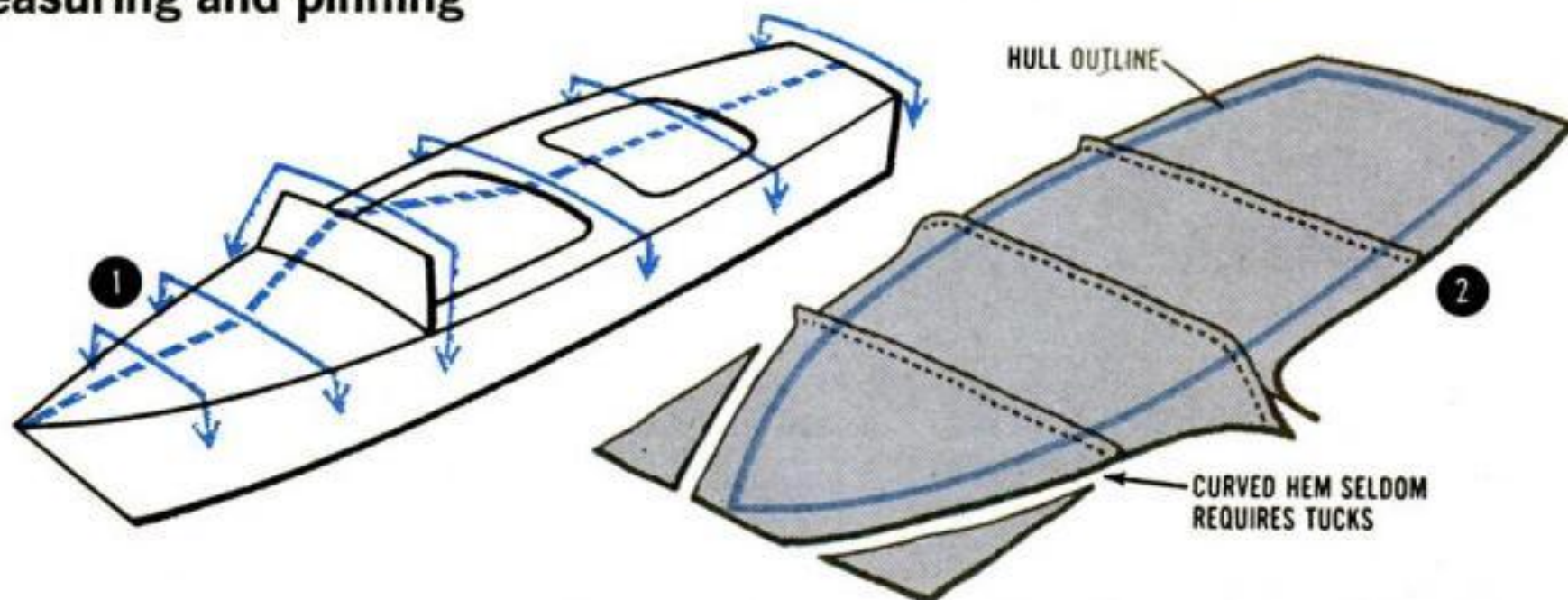
## How to make a canvas cover for your boat



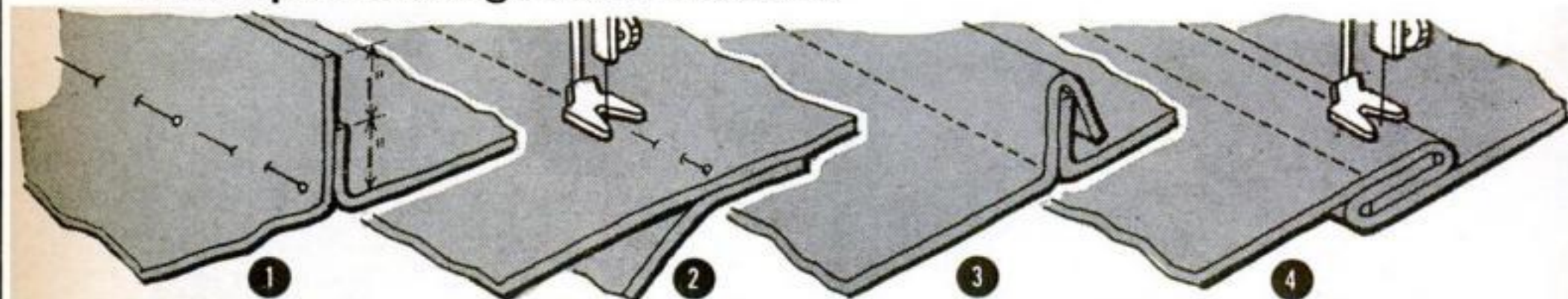
**Suit the cover to the boat:** The easiest to make, and cheapest, snaps to the coaming (1). If an outboard sets in the well of a high-sided hull (2), plan the cover so you can draw it over the motor, double it back to fasten to the transom. If motor power head is high, separate

cover (3) is easiest. Waste canvas trimmed from the bow section is usually enough to make it. Box as for trailer cover (shown later on). Thread drawstring through grommets in hem. If the windshield is rigid enough, you save by fastening the cover to it (4).

## Measuring and pinning



## The steps in making a seam in canvas

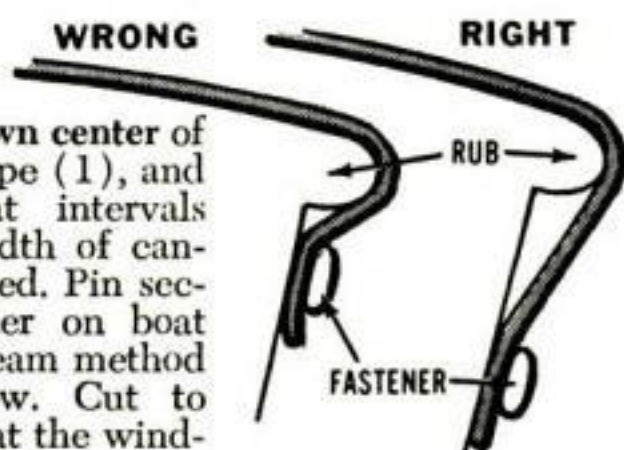
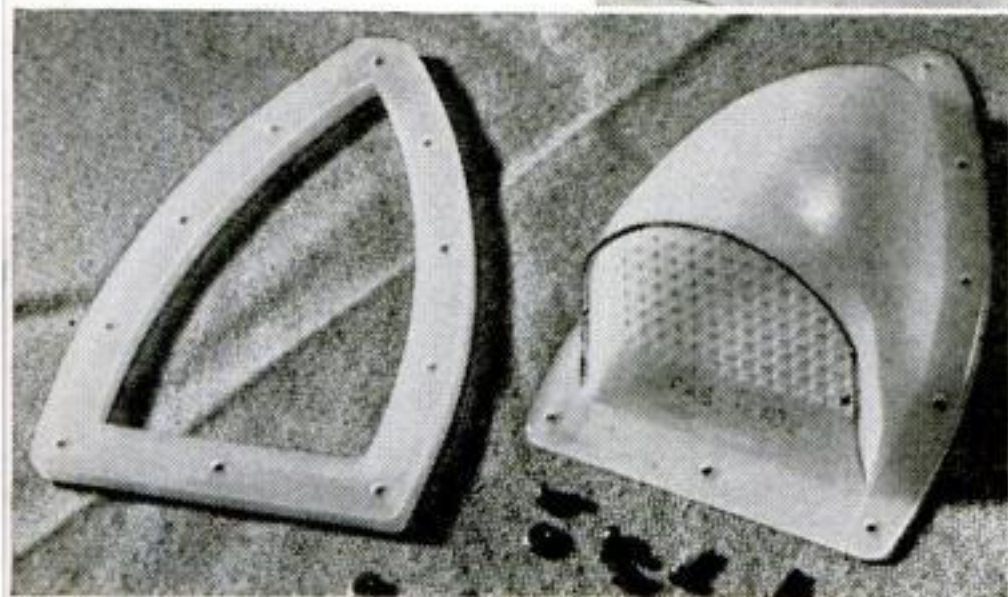


Pin the seams close to the deck (1) with the 2" flap on the bow side of the seam. This will assure that the seamed flaps wind up shingling aft. Next, fold the 2" flap down flat over the 1" aft flap and stitch along pin line (2), re-

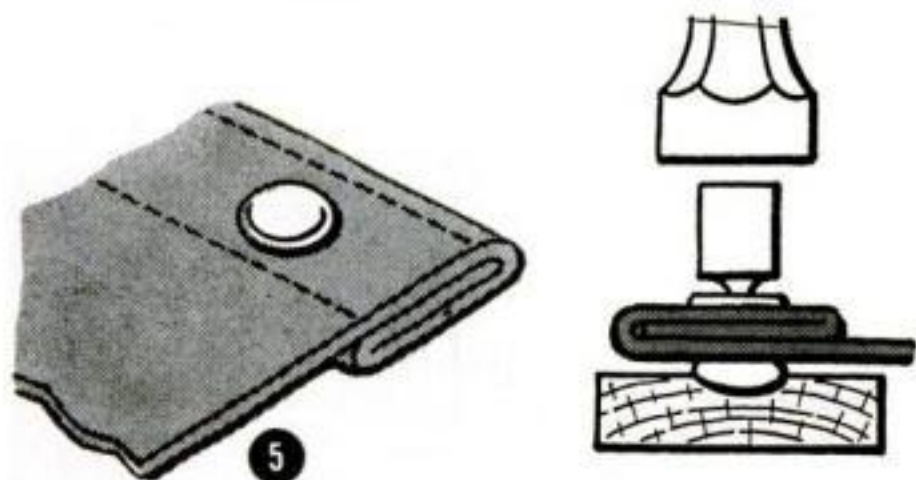
moving pins as you sew. Now fold the high flap over the low (3), fold all layers flat, and stitch again (4) to finish. Make a three-layer hem all around the cover, as shown (5), with fasteners set between lines of stitching. A die



Vent all covers to prevent dry rot and free explosive vapors. Forward vents should face forward, aft ones to rear. Sewn vents usually collapse and are ineffective. Better is vent held open as at right by interior pole. Easiest to install are ready-made plastic ones like that in the photo below.



Measure down center of boat with tape (1), and across it at intervals equal to width of canvas to be used. Pin sections together on boat (2) using seam method shown below. Cut to put a seam at the windshield so the cover can angle up more easily. Mark the hull outline on the pinned-up cover, using chalk or burnt cork. Trim to allow for three-layer hem, shrinkage, and sufficient pullover (above). Trim allowance usually required is about 14".



kit for flaring fastener parts together through canvas is available at most dealers. Use a hammer to work it as shown in sketch above. Or you can make holes where you want fasteners and have an awning maker install them.

## What the Terms Mean

Terms used in the accompanying article are defined as follows by Webster's:

**Balloon cloth.** The cloth, generally cotton of which balloon fabrics are made.

**Canvas.** A heavy, closely woven cloth of hemp or flax, used for tents, sails, etc.; also, a similar cloth of tow, jute, or cotton, or a mixture; now, esp., a heavy cotton cloth with a diagonal weave.

**Drill.** A heavy fabric of linen or cotton with a diagonal weave. [The diagonal lines are pronounced.]

**Duck.** A linen or cotton fabric, finer and lighter than canvas, but similar . . . used for dresses and sports garments, and in heavy grades for tents, sails, awnings.

**Tarp, or tarpaulin.** Canvas covered with tar, paint, or other waterproof composition, esp. when in a large sheet and used for covering the hatches of a ship, hammocks, boats, etc.

to create striking room dividers, screens, and windbreaks.

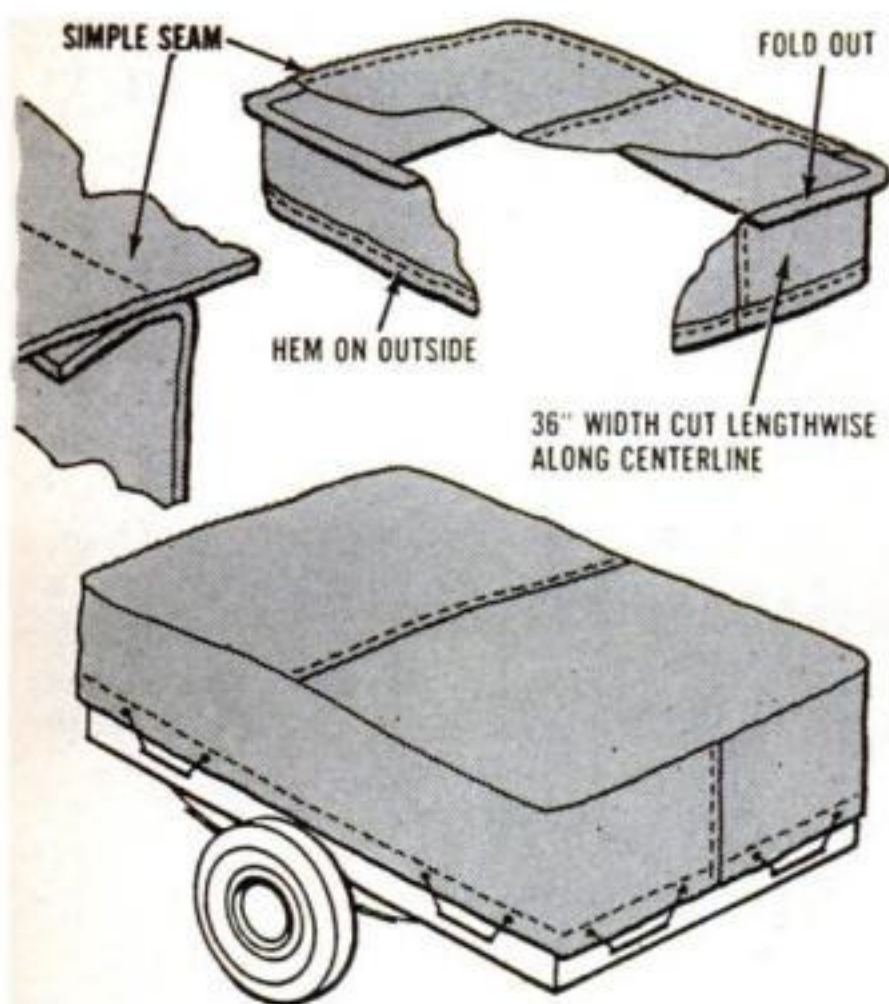
**What to buy.** Suit the material to the job according to weight, weave, and treatment. Buy your thread where you buy canvas and be sure it's cotton. Cotton shrinks and swells with the fabric—won't cause puckered or dripping seams.

Terminology varies greatly among manufacturers, with designations like 3.9-ounce balloon cloth or No. 502 duck often meaning pretty much the same. To be sure you get the right material, tell your dealer what you will use it for. Also ask him to translate product designations into equivalent weights. Traditionally, canvas was specified by the weight in ounces of a yard-long piece 28½" wide—an old sailmaker's width. Now, it is sometimes given as the ounces in a square yard.

Try a sample on a sewing machine before you buy. If the machine labors on hem and seam thickness, try fabric about two ounces lighter. If you have trouble only with thick layers at junctures, you can



## Making a trailer cover



**Boxed trailer cover**, one with square corners, is made as shown here. Fit the rim directly around trailer and pin on top piece with seam laps showing. Turn hem up. After stitching, reverse the cover so seams and hem are inside.

use the heavier fabric and sew these points by hand with a sailor's palm and needle.

**Boat and trailer covers.** Use 12-ounce double-filled duck (this has twice as many cross threads) treated to make it water-repellent and mildew-resistant. Pick a dark color to hide soil. Laundering even once can spoil the treatment. Expect to pay

about \$1.25 a yard for the only width generally available, 36". Don't be tempted by widths up to 6' or 10'. That's tarp. It won't do. The rotproofing treatment in this material may stain your boat.

**Deck chairs.** Use 10-ounce, single-filled duck, treated or untreated. Water-repellent, mildew-resistant fabrics are generally more durable, but have the drawback of holding puddles after a rain. Untreated duck is around 50 cents a yard in 29" widths.

**Lightweight tents, porch curtains.** The established material here is water-repellent khaki drill. You can spot it by the pronounced diagonal weave pattern. It's commonly available in 7.8-ounce weight and 30" width at about 60 cents a yard.

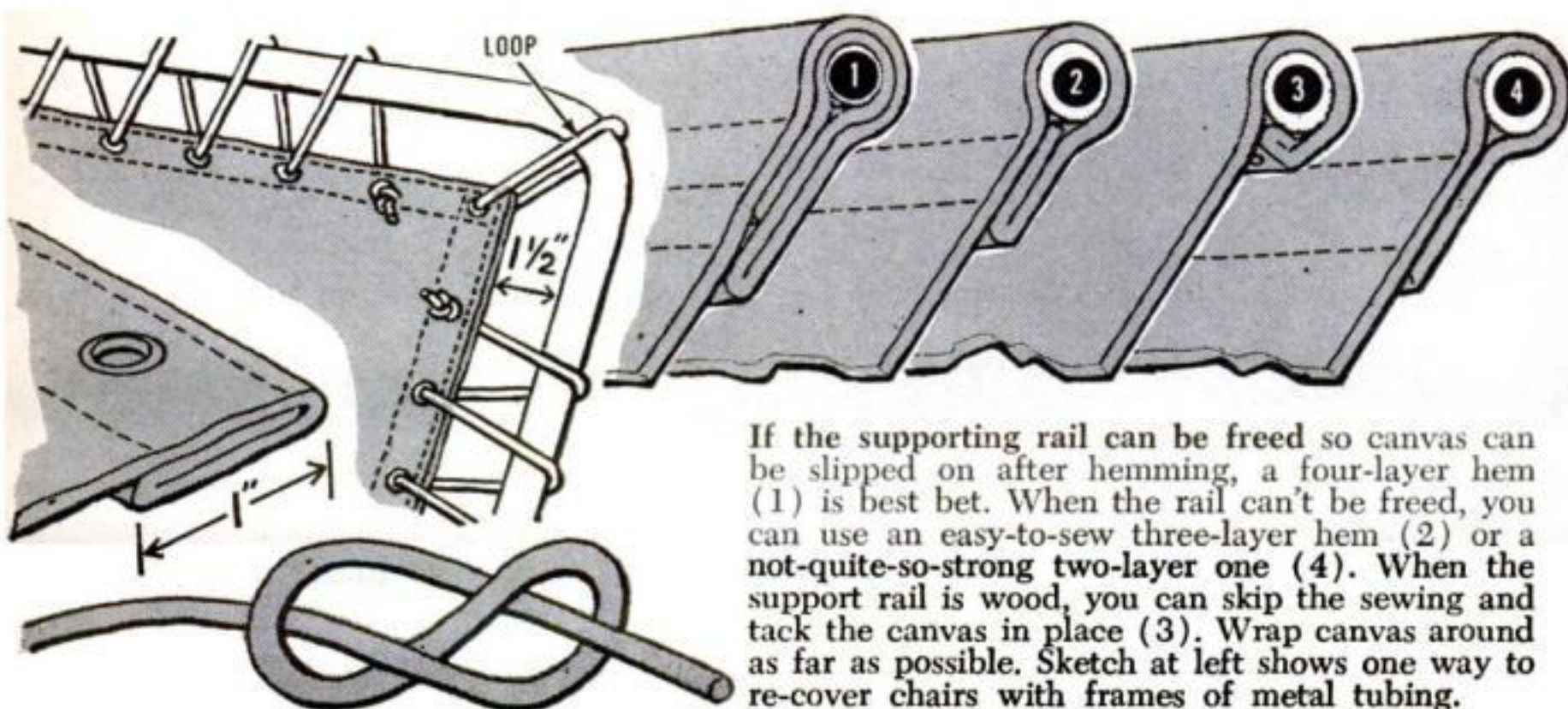
**Tarps and winter covers.** Use 10- to 15-ounce, single-filled duck. Widths run from 4' to 10', prices from about a dollar a yard up. Be sure it's treated for tarp use.

Shrinkage is the thing most likely to trap the unwary. When you soak new canvas, it shrinks. (Even preshrunk types shrink a little.) When it dries, some of the shrinkability disappears. After that, it shrinks when wet, goes back to normal when dry. This is the shrinkage you'll have to make your peace with in designing any close-fitting cover. Fit it taut when dry and it will probably be impossible to fasten when wet. Fit it wet and it'll be slack and saggy when dry. The practical answer is to fit the material wet and rely on bows or other supports to eliminate dry sags.

**Making a boat cover.** The size and de-

[\[Continued on page 192\]](#)

## Pointers on fitting new canvas to lawn chairs

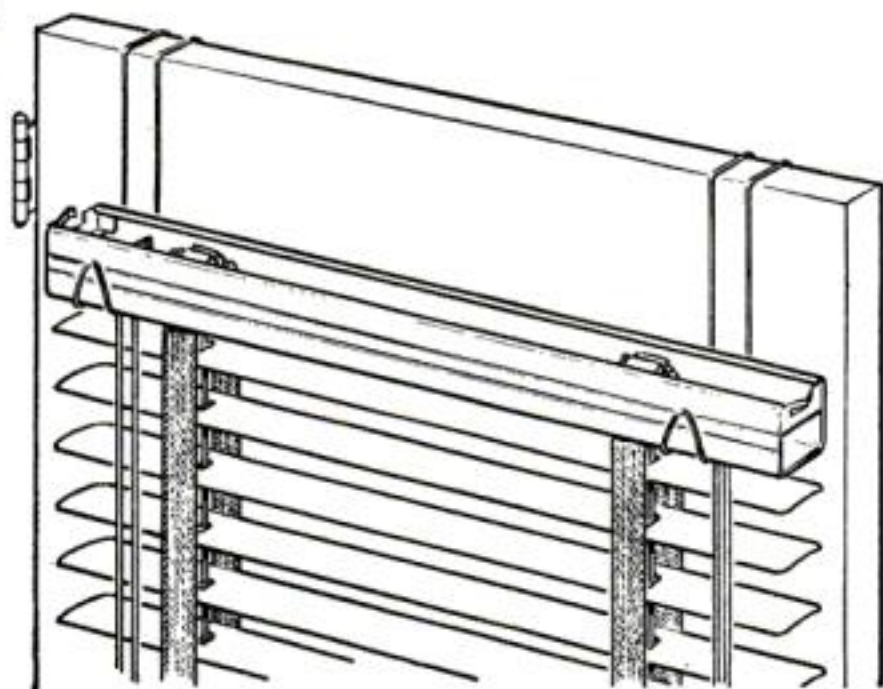


If the supporting rail can be freed so canvas can be slipped on after hemming, a four-layer hem (1) is best bet. When the rail can't be freed, you can use an easy-to-sew three-layer hem (2) or a not-quite-so-strong two-layer one (4). When the support rail is wood, you can skip the sewing and tack the canvas in place (3). Wrap canvas around as far as possible. Sketch at left shows one way to re-cover chairs with frames of metal tubing.

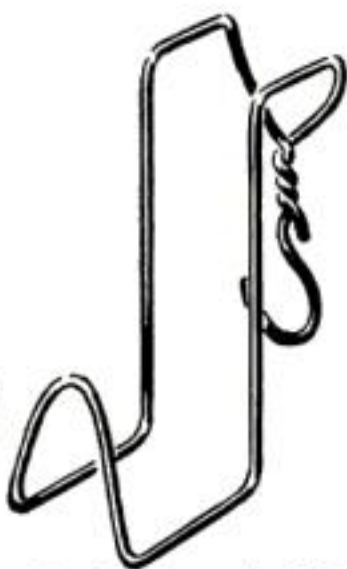


# Popular Science Fix-It File

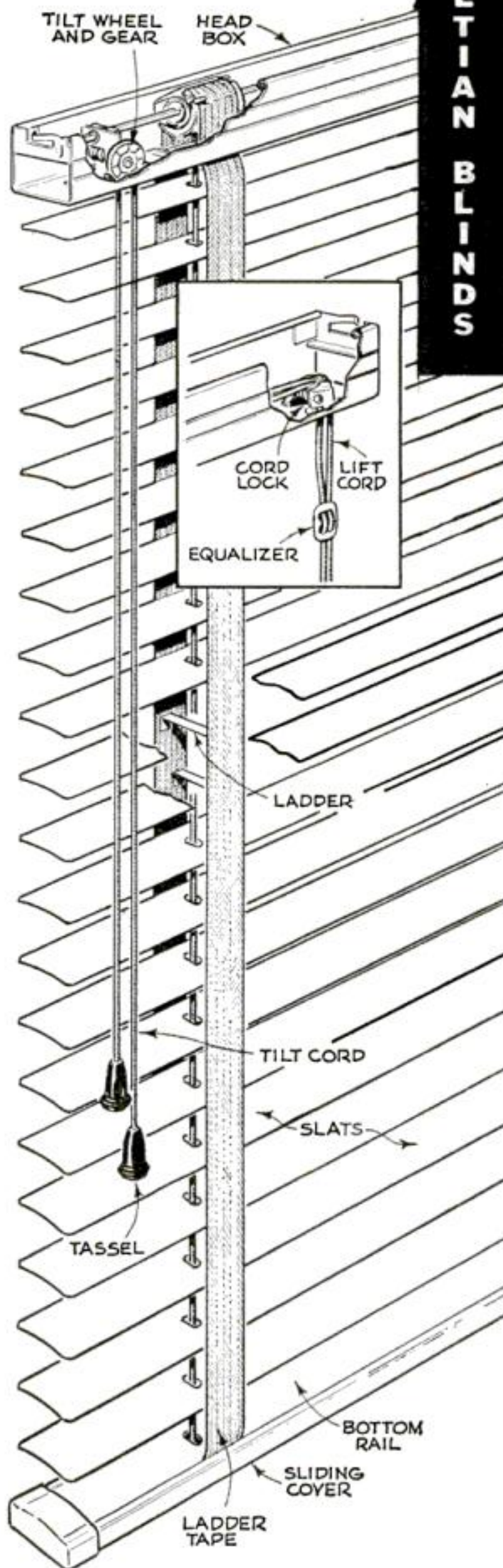
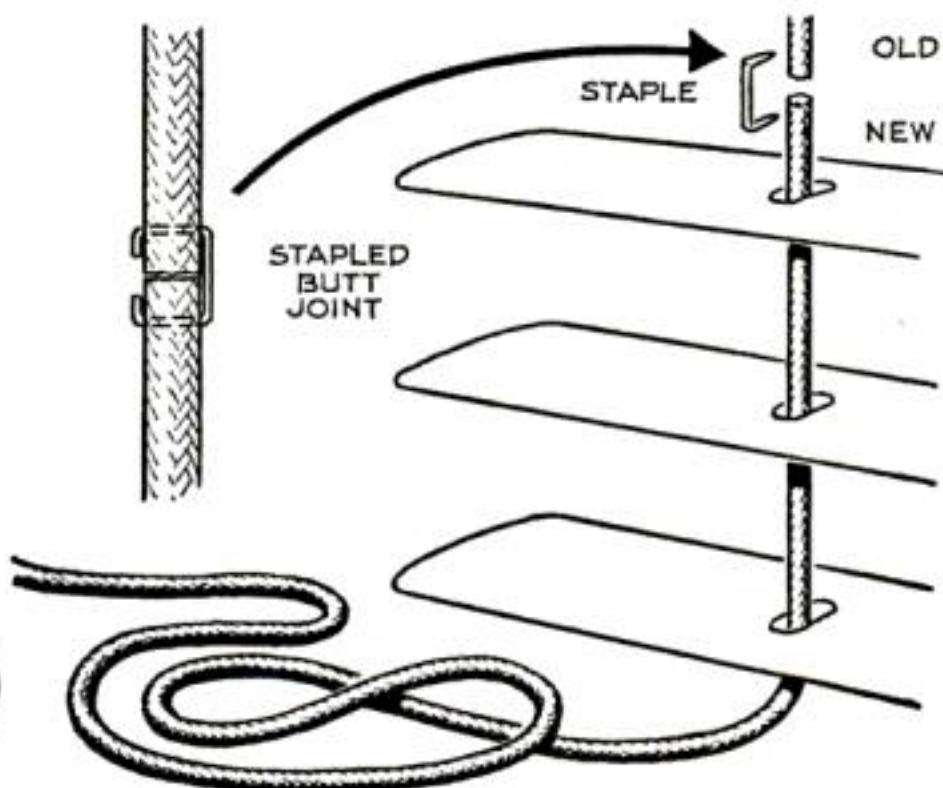
## VENETIAN BLINDS



Suspend the blind on a door while you're making repairs, using hooks made from wire coat hangers bent as shown at left. In this position, you can install new cords, tapes, and other parts shown in sketch at right, using repair kits available from department stores and mail-order houses. Besides tape and cord, kits contain new tassels and an equalizer.

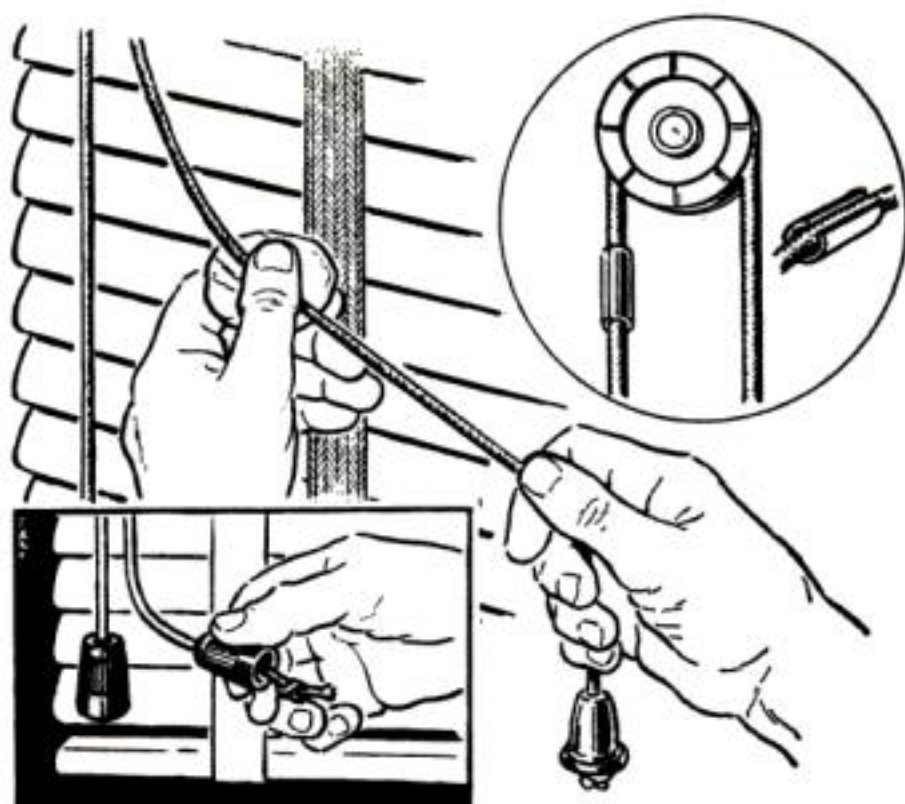


Replacing the lift cord is no trick at all if you attach the new cord to the end of the old. Free the two ends of the original cord at the bottom rail first and remove the equalizer. Then cut off one end square, butt the end of the new cord to it, and staple the two together as shown—or sew or tape them together. Finally, draw the new cord through the slats.



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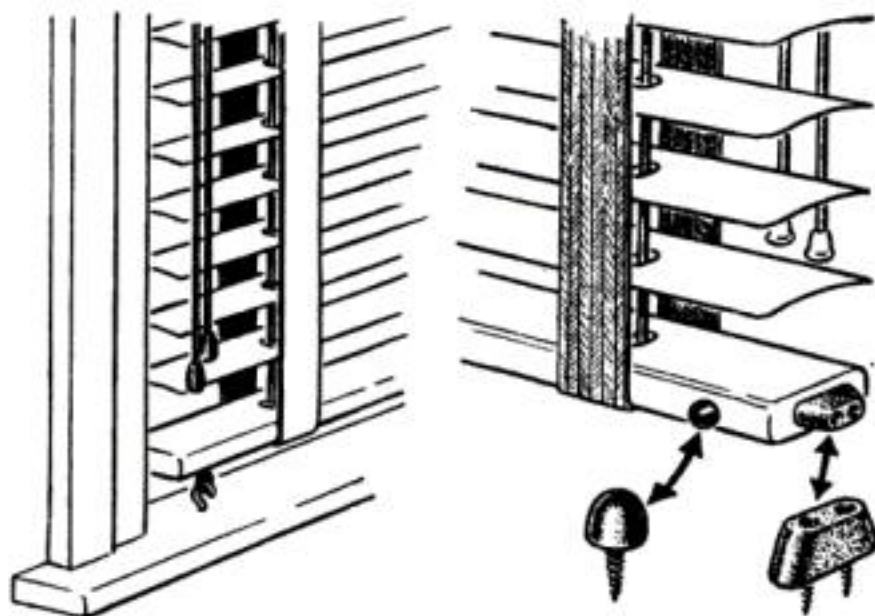




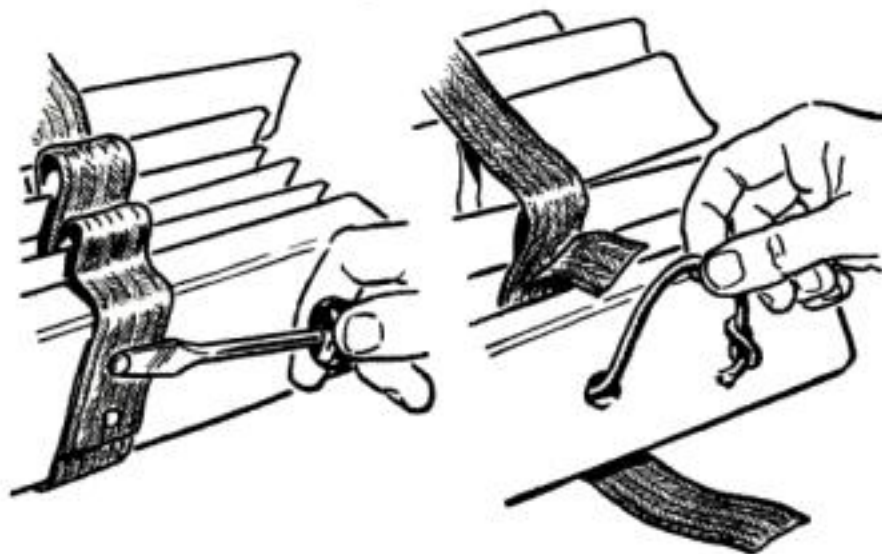
**Tips about cords:** On metal blinds, cords are apt to wear out faster because of rubbing on the sharp edges. They'll last longer if you wax them by rubbing over a block of beeswax.

To keep one end of tilt cord from creeping up to the wheel as it always tends to do, slit  $\frac{1}{4}$ " metal tubing and crimp it on as shown.

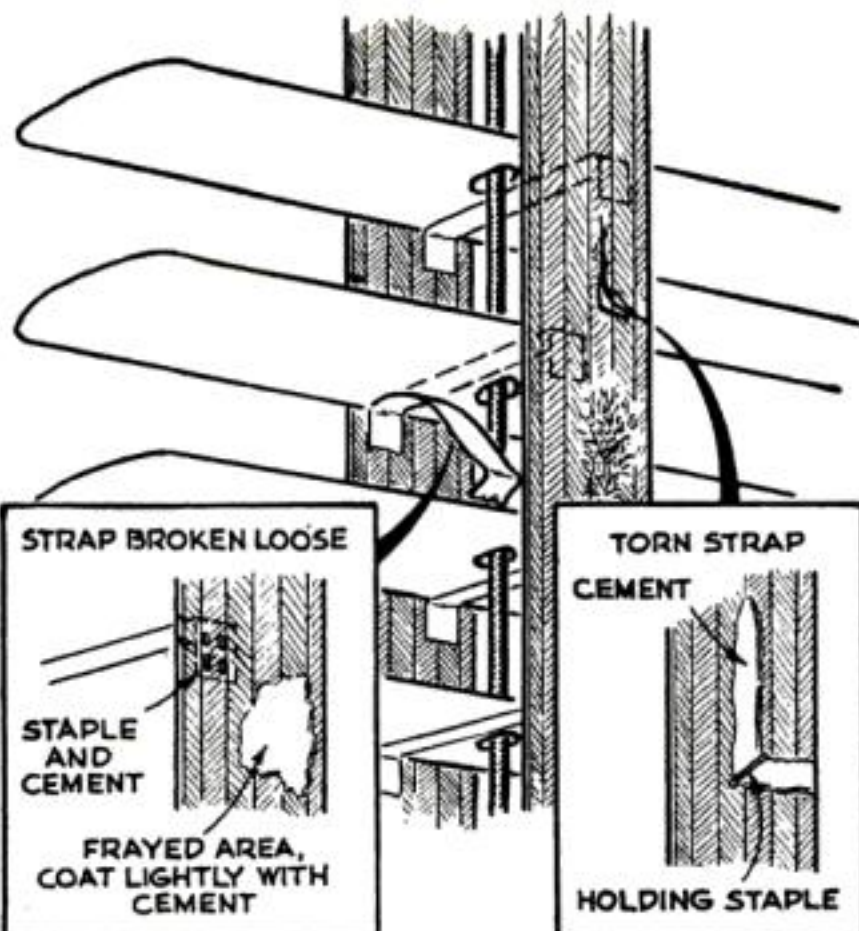
A large solderless connector can be used as a replacement tassel. Remove wire spiral and drill end. Coat it with colored enamel.



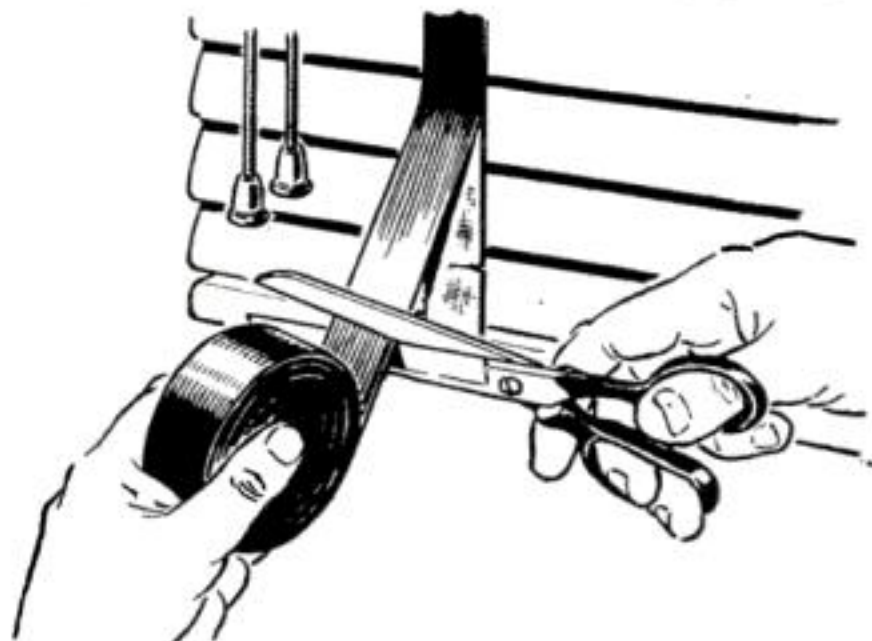
**Do your blinds rattle and bang when the window is open?** Here are two ways to quiet them: Install cup hooks and screw-eyes as shown, or attach rubber bumpers made for toilet seats.



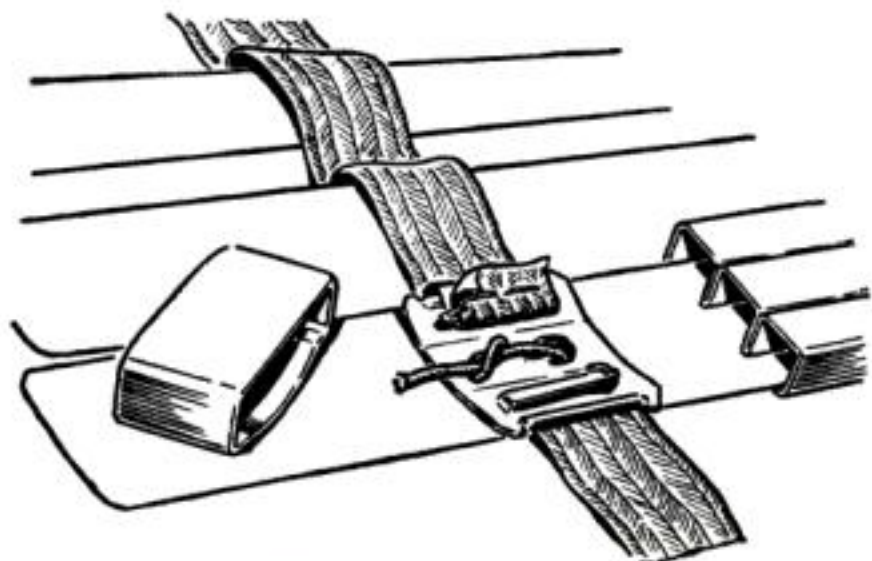
**Shortening a blind to fit the window is easy.** On wood blinds, pry the tape-retaining tacks from underside of bottom rail and untie the



**Tape repairs** can be made with staples and household cement. Or use contact cement if a ladder comes loose from a washable plastic tape. After the cement has dried for about 20 minutes, press the loose ladder in place and clamp it for about 24 hours with a paper clip.

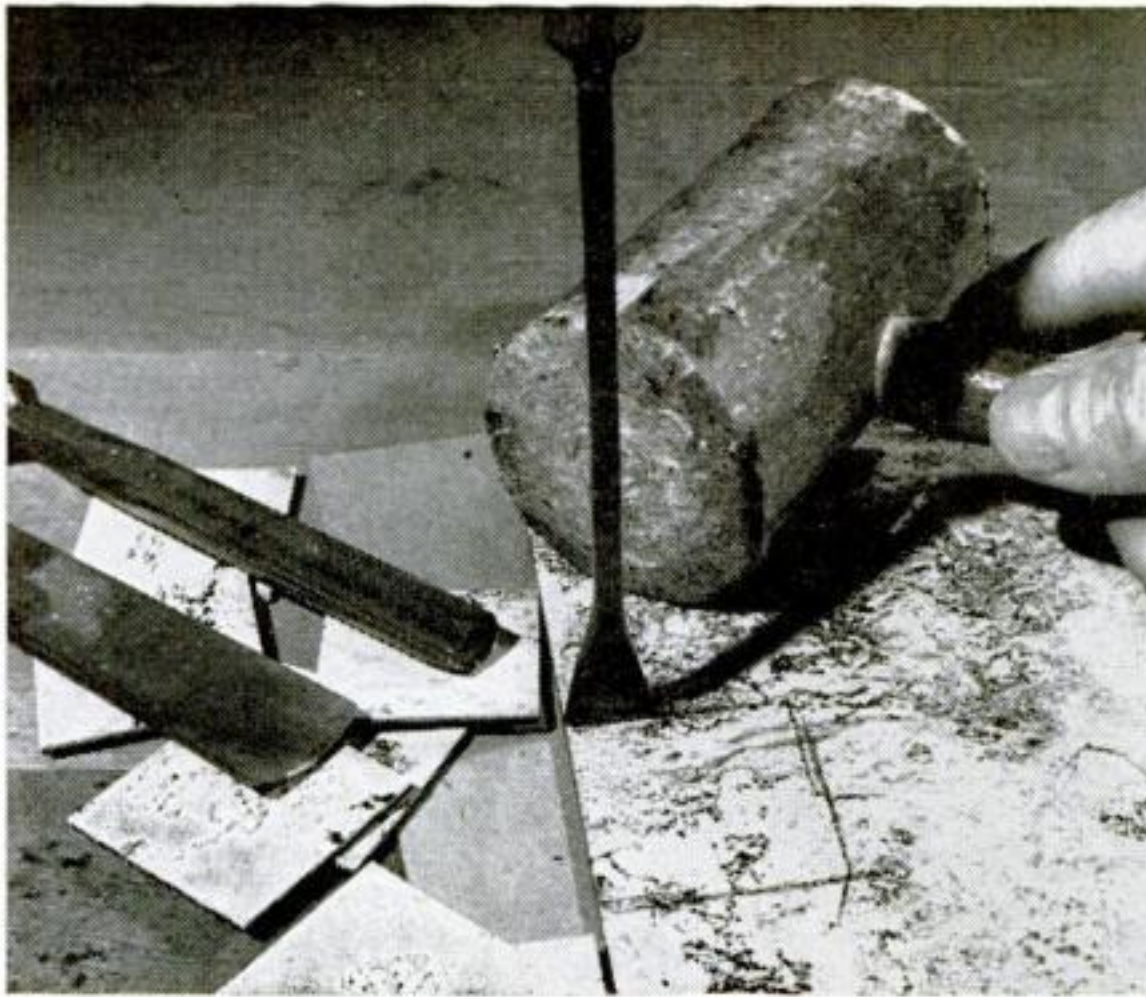


**You can add new color and life to old tapes** by simply covering them with lengths of adhesive-backed tape. Such tape is now readily available in various widths and colors.



cord knot. On metal ones, free both from the retaining clamp. Discard slats to shorten as desired, and cut off the excess tape.





## Short Cuts and Tips

FROM PS READERS

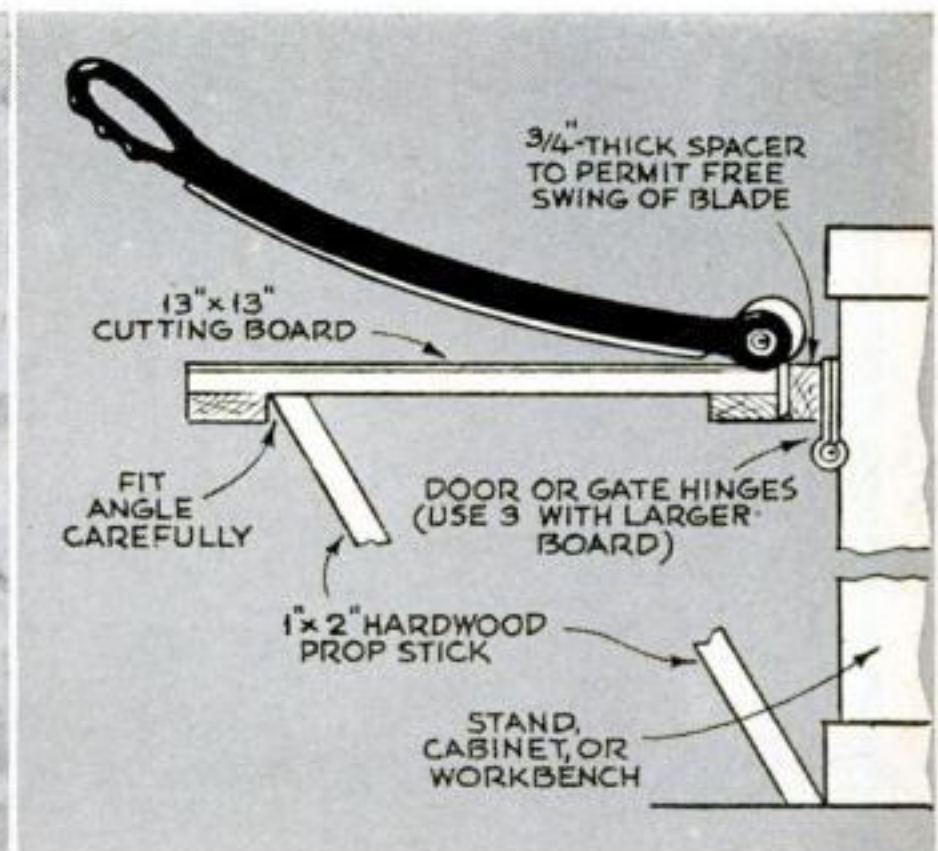
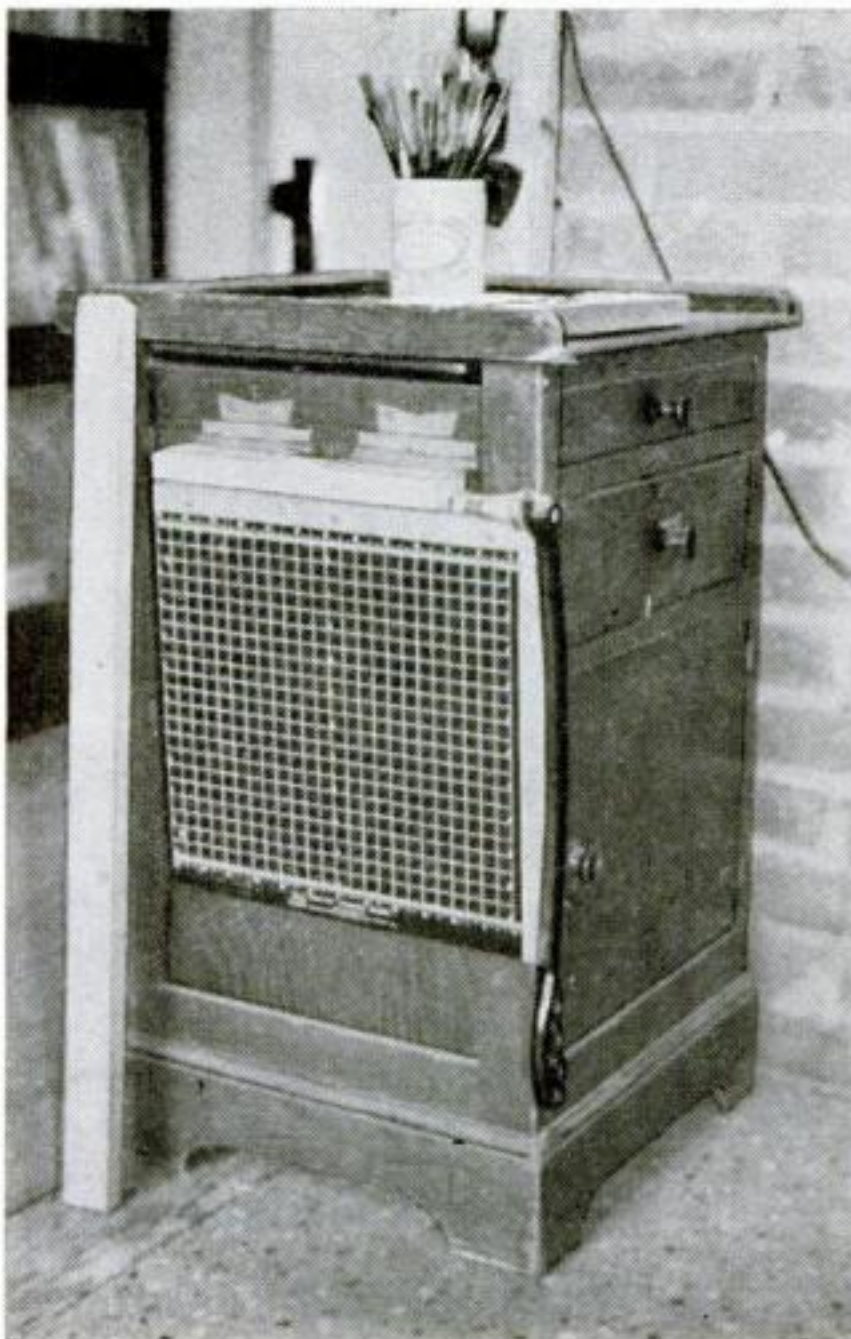
### Notch linoleum or floor tile with a chisel

Woodworking chisels or gouges will notch flexible floor coverings around obstructions such as pipes and the bases of plumbing fixtures. Struck with a mallet, these tools cut a crisper and more accurate line than the usual hooked linoleum knife, and can't accidentally tear the material or overcut lines.

—Ken Murray, Colon, Mich.

▶▶▶Drilling, chipping, or sanding plaster creates a fine white dust that's a job to clean up once it settles. Try turning on a vacuum cleaner near the work site. This sets up air currents that will route the dust to the intake as it sifts down.—Henry J. Miller, Lanham, Md.

▶▶▶Building a boat? For waterproof seams without calking, soak  $\frac{3}{8}$ " felt weatherstrip in shellac and place it between sections to be joined. When the joints are screwed tight, the felt is compressed. Once it dries, it can be worked with tools and sanded.—John C. Jahoda, Lebanon, Conn.



### Drop-leaf paper cutter saves space

Though a paper cutter often comes in handy, it rarely earns its space in a small shop or office. I hinged mine to the side of a cabinet, using removable-pin hinges so I could detach it for use elsewhere. The brace isn't attached; I just prop it under the cutting edge of the raised board.—H. A. Fluchere, Irvington-on-Hudson, N. Y.



Using junk auto parts, you can combine the features

# A Teeter-Go-Round



**fun for  
TWO**

Two kids spin into orbit with ease. Launching pad is pea gravel in staked circle of redwood battens. Solo flights are fun, too. Sturdy front-coil springs provide plenty of counterbalancing lift.



**...or ONE**



of a teeter-totter and a merry-go-round

# for the Youngsters

By Bob Gilmore

**W**E TURNED our yard into a whirling one-ring circus for the kids—and it cost us only about \$30. To make the rig, I welded up a swivel from old auto parts and centered a 14' two-by-twelve on it. Its shaft is set in a concrete footing at the center of the circle, with a 2"-thick bed of pea gravel. The gravel is nonabrasive, and softer and cleaner than the ground.

Besides heightening the fun, the spring action makes the unit safer than an ordinary seesaw by eliminating those spine-jolting drops when one child leaps off without warning. The spinning plank could be dangerous for toddlers, but they shouldn't be permitted to run free near any playground equipment.

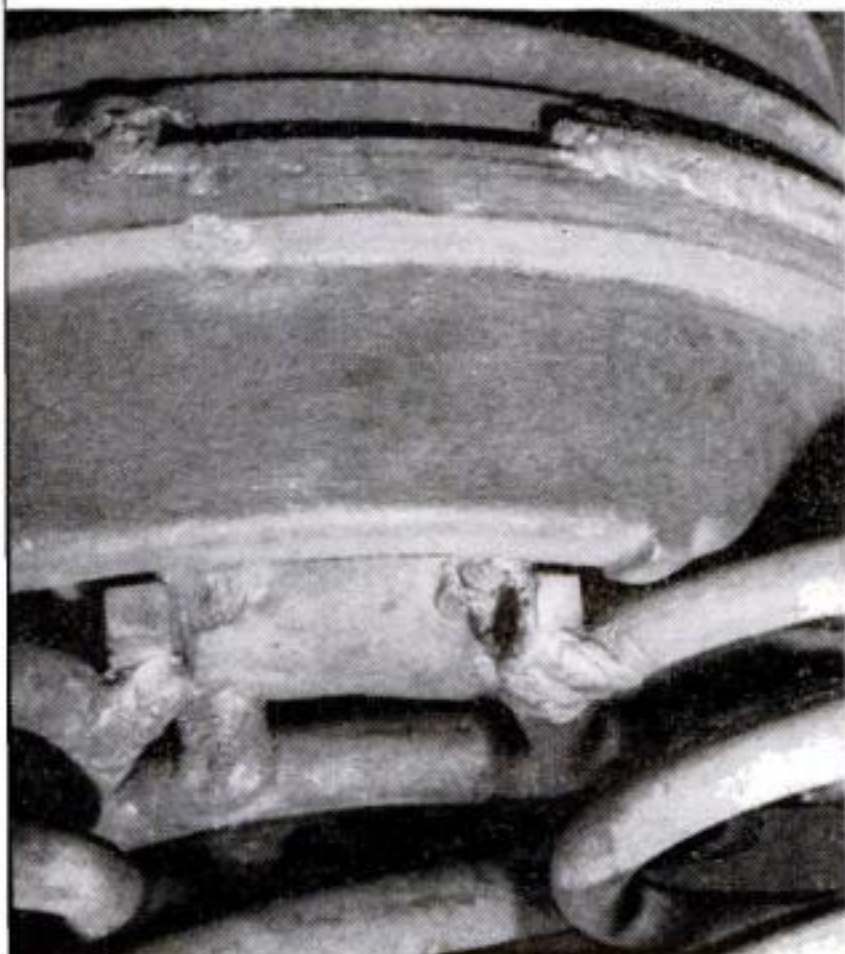
The welding is simple, and shouldn't cost much if you don't want to undertake it yourself.

My model has five springs—by fluke. I originally tried to get by with a single central coil from the front end of a heavy car. My advice: Don't. Such a unit whips like the tip of a fly rod at the lightest touch. I stiffened the action by grouping four lighter 14" springs (from a '52 Chevy) around the center one. Omitting the center spring and using four heavy 16-inchers would do as well. And these could be

To bridge gap between springs and shaped disk of brake drum, weld  $\frac{1}{2}$ " nuts to disk before attaching springs.



Mounted on axle-shaft supporting stem are: brake drum, to serve as base for the coil springs; second drum at top of springs (optional); and complete front-wheel assembly to which plank fastens. Shaft slips into pipe socket sunk in ground (below). Welded-on rods radiate into trenches to reinforce concrete "dead men."



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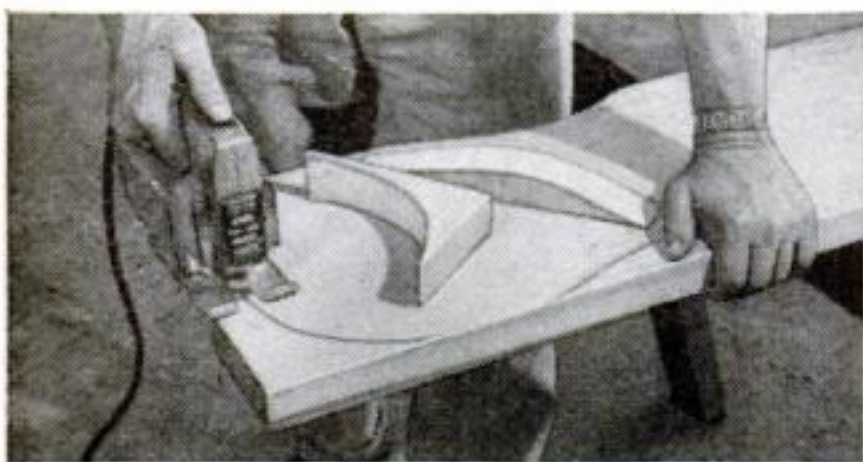


welded directly to the wheel assembly, if you wanted to skip the top drum. To lighten the drums, strip them of removable innards.

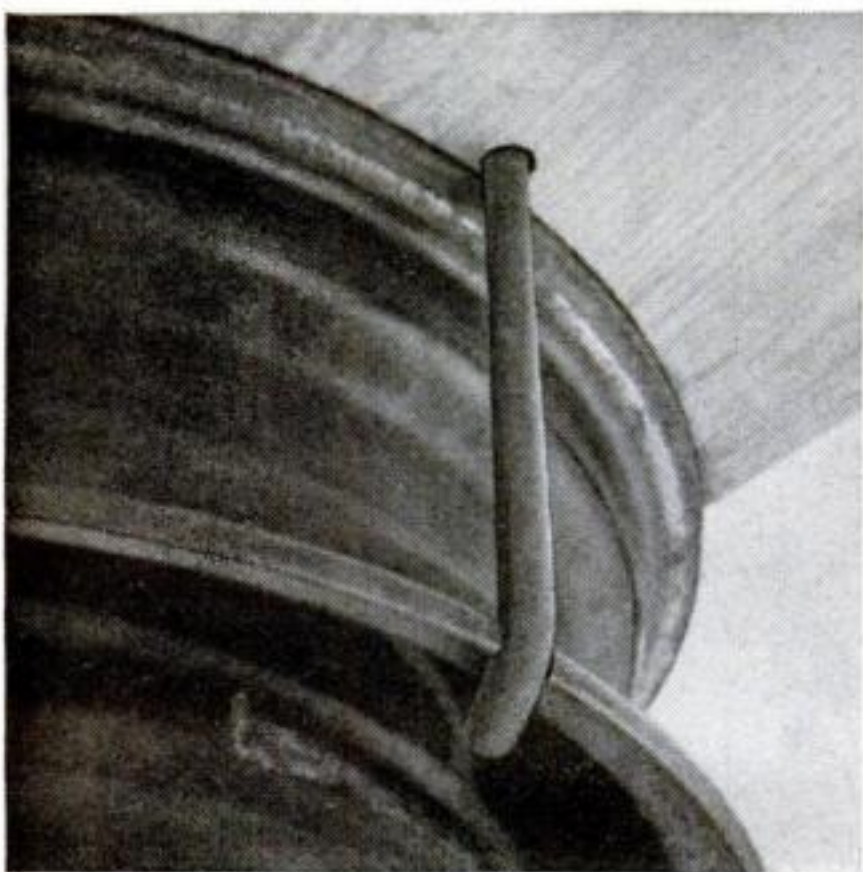
Heavy welds are needed for durability. I used stainless-steel rod, reinforcing the coil joints by bending 20-penny nails around the spring and over the rim of the drum.

Be sure to rasp the corners off the seat plank, and sand it smooth. For handles, screw a pipe flange to the face of the plank and turn a 6" nipple into it. On the top end, screw a tee, with capped nipples projecting at each side. Half-inch pipe makes a good, safe grip for small hands.

I finished the plank with marine varnish and brushed rustproofing paint on the handles. Since the car parts came with their own greasy coating, I left them unfinished. They could be steam-cleaned and sprayed with a good outdoor paint. But you may not be able to fight off the small fry to do it this close to the blast-off stage. ■ ■



Cut paddle-shaped seat on each end of plank with saber saw. Lay out contour on one edge; trace around waste stock to duplicate on other.



Worm's-eye view shows how plank is clamped to wheel with two 8" sill bolts. The bent ends bite under the rim through hacksawed notches.

# Compact Camping Kitchen

Two boxes pack all cooking gear  
—and set up into a work counter

By Richard W. Sullivan

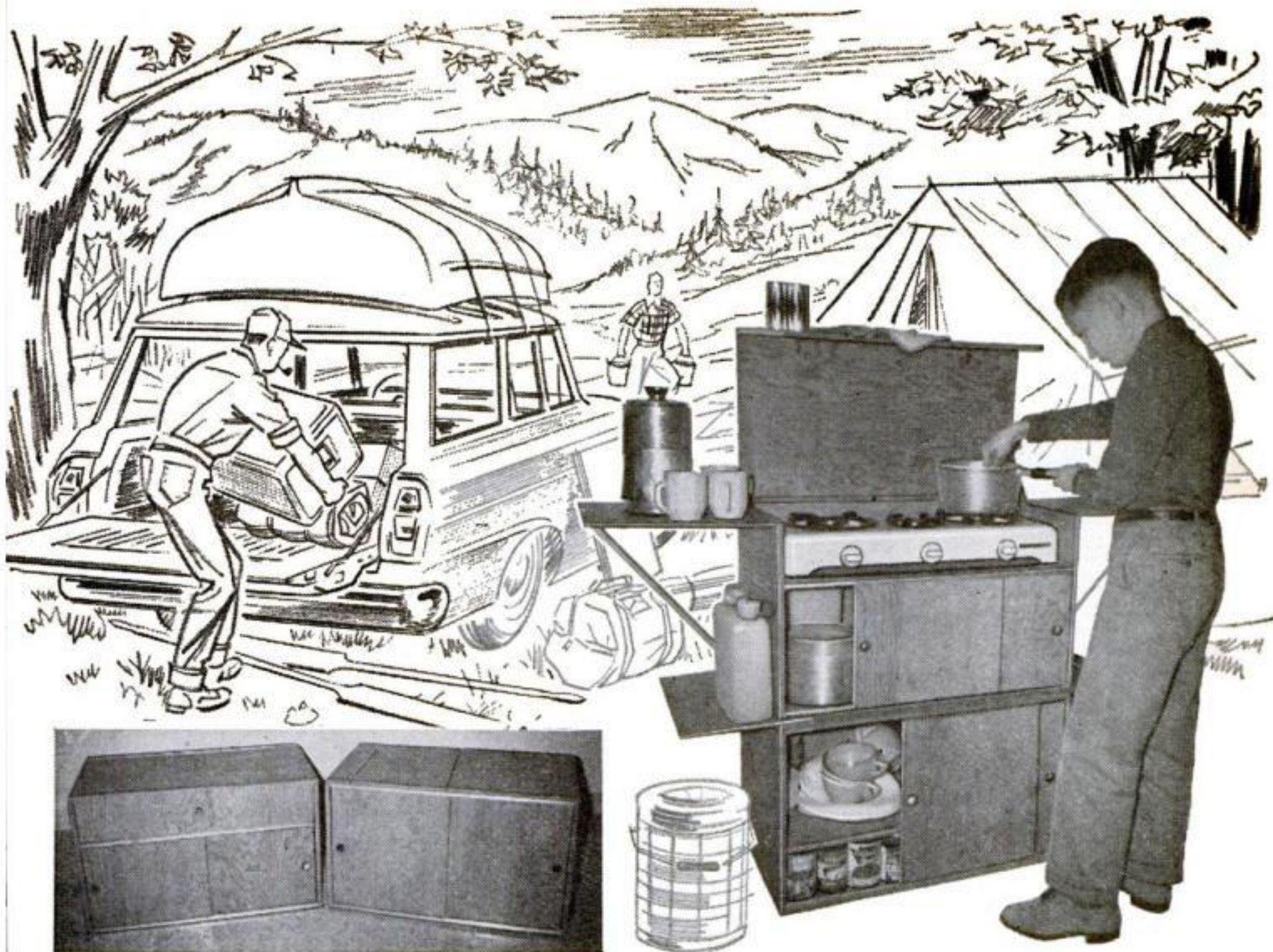
**W**E USED to tote our camping vittles in four or five cardboard boxes. They were organized when we started, but after a few meals, pans were in with the groceries, ketchup was lost among the soaps, and it was a major project to collect the ingredients for a sandwich.

We sat down to figure out just what was needed to bring permanent order to this jumble, and after a full season's trial we've voted our design a total success. We wanted two cupboards, compartmented to hold all cooking and dining equipment and canned goods—yet light and compact enough to lift into the car trunk. We wanted them of a combined height that would provide a handy work counter.

The length and width were determined by our decision to build a 14"-by-26" three-burner bottled-gas stove into the top chest. This plan also suggested a wind-screen arrangement: The lid is raised against the prevailing breeze, held up by a pivoting brace that slips onto one edge. If side drafts must also be screened, either or both flaps can be braced erect to form a hood. The same detachable props, made of aluminum channel, brace the flaps in work-space position. To keep the top end from slipping off, drill a hole in the flange that will snap over the head of a round-head screw driven near the edge of the flap.

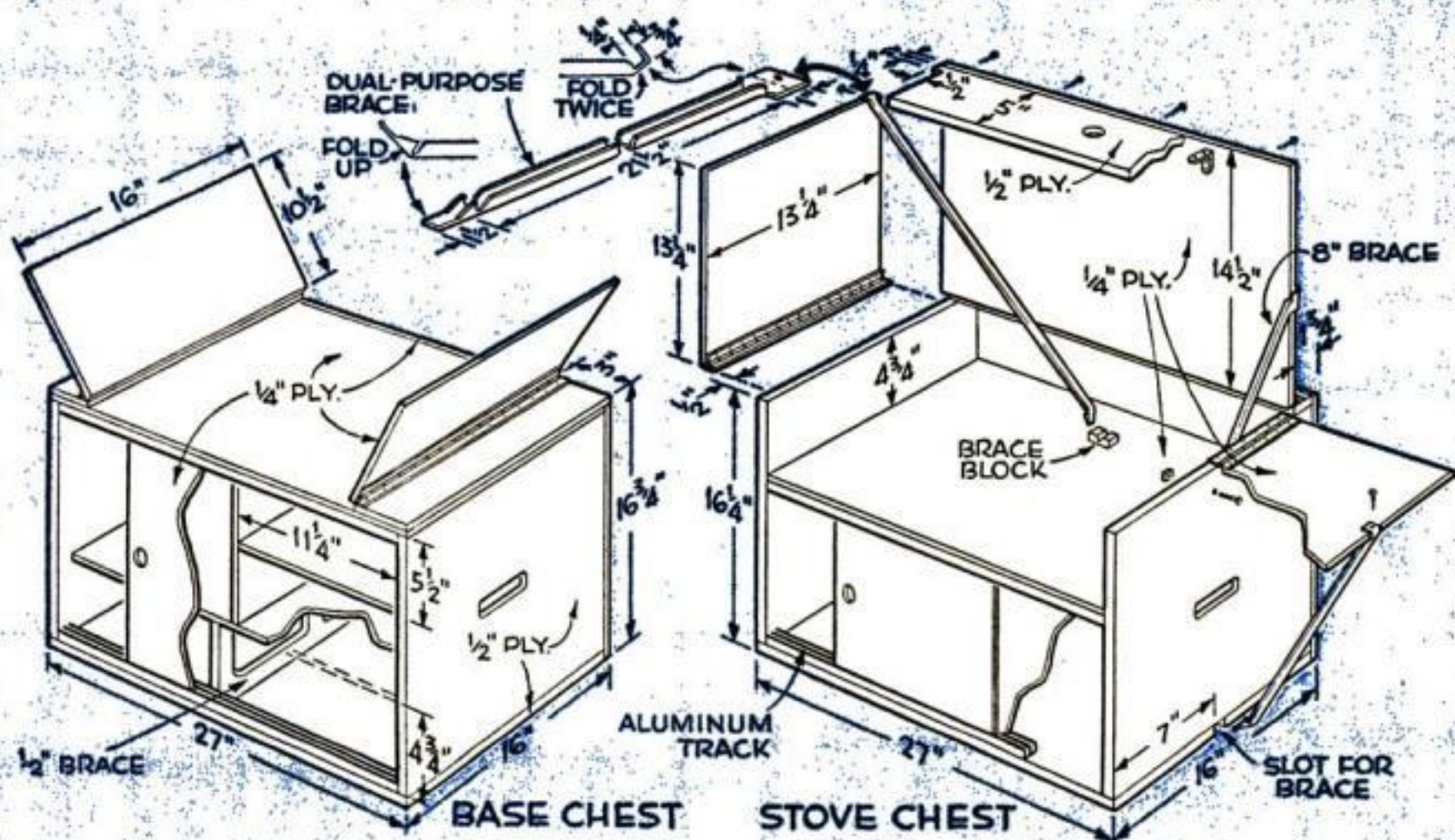
When you pack up, fold the flaps in over the stove before dropping the lid. Store the props inside, behind the stove.



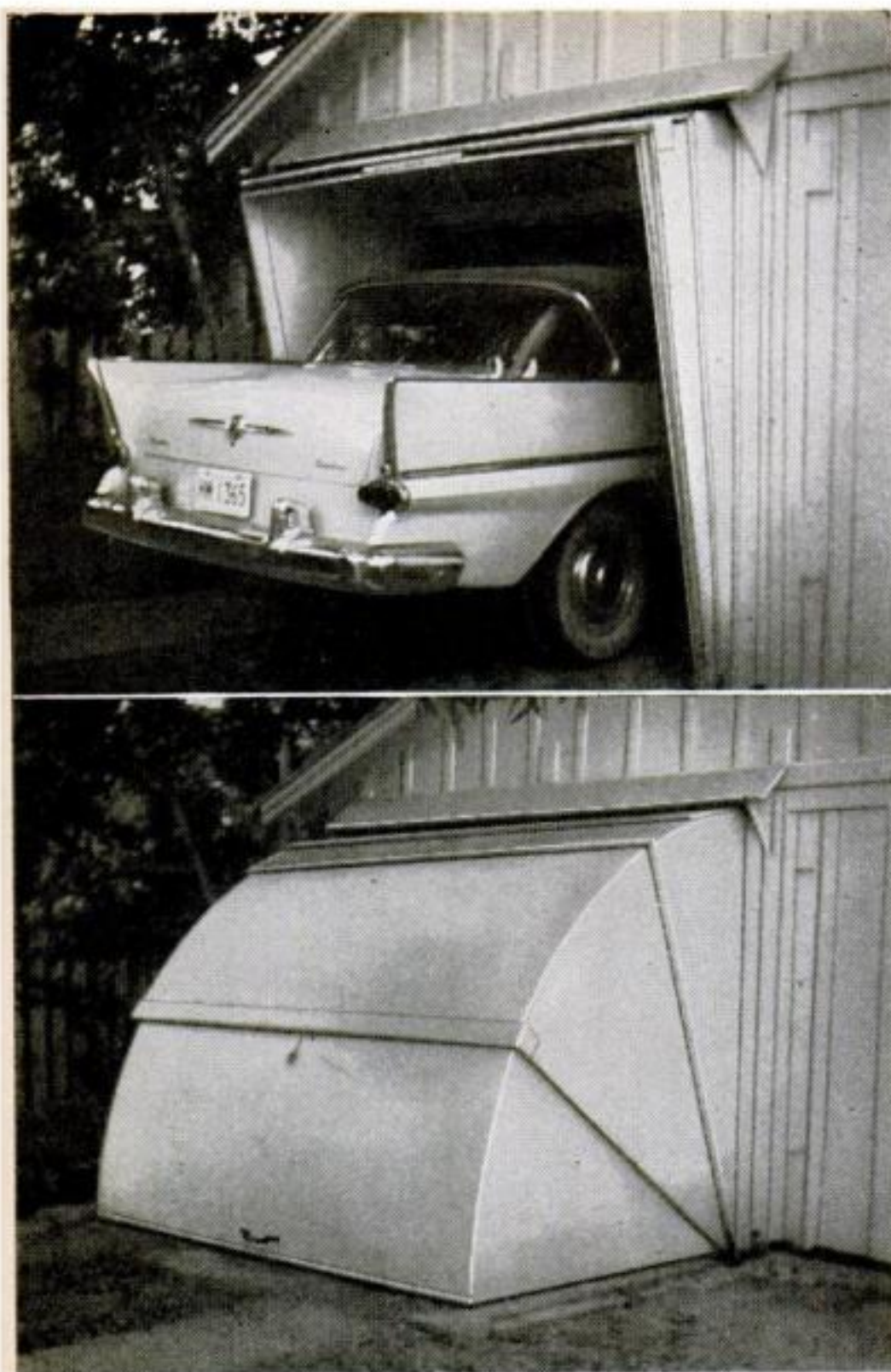


Ready for loading in station wagon or car trunk, two chests contain all kitchen needs. Stove and cooking utensils are in the box at left; the box at right is a canned-goods pantry.

To make a cooking counter, chests are stacked, with flaps out and top up. Bottom flaps are pinched between, so need no braces. Canned-goods box is heavier, makes a sturdy base.







Rear half of car stuck out when far end of this garage was converted into a workshop. Telescoping extension leaves plenty of headroom (top photo) when raised; but lowered (bottom), shelters car and closes garage to intruders. Side door at right provides separate entrance.

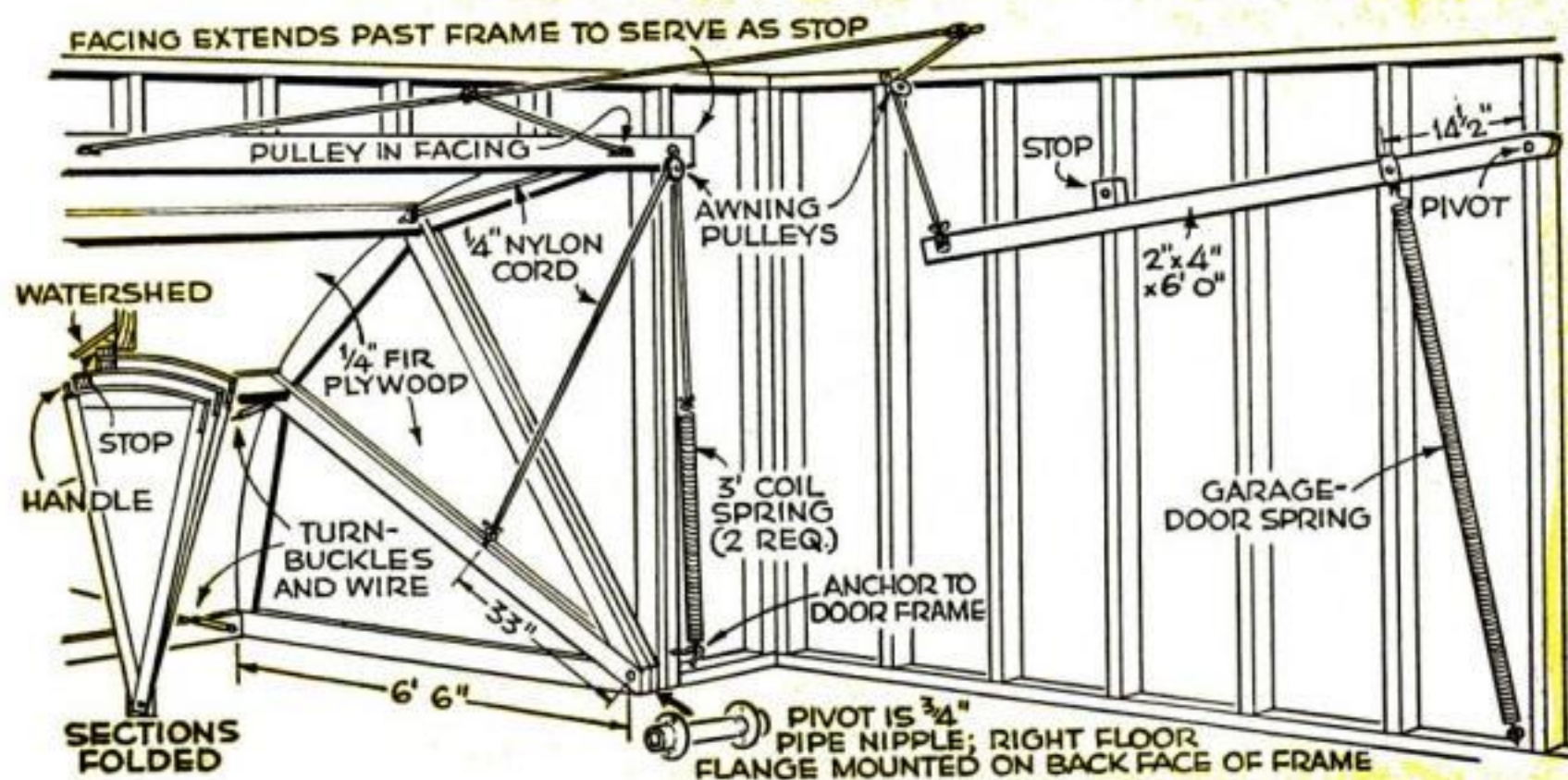
# Buggy-Top Garage Door

By Ben H. Wagner

GETTING my car under cover was a real problem when I decided to install a workbench across the end of my shallow, single-car garage. The garage backs on an alley, so I couldn't tack on a shed; and a carport projection at the front would leave the tools in my shop vulnerable to theft. What I needed was an inexpensive extension that would encase the projecting rear half of my car, closing the garage tight.

My solution is unconventional, but it has proved mighty practical. I built a three-section hood that works on the principle of the old-fashioned buggy top. I curved three 4'-by-8' sheets of fir plywood around one-by-four frames designed to fit within one another. These three units pivot inside the existing door frame. When raised, they telescope and tilt forward into the garage.

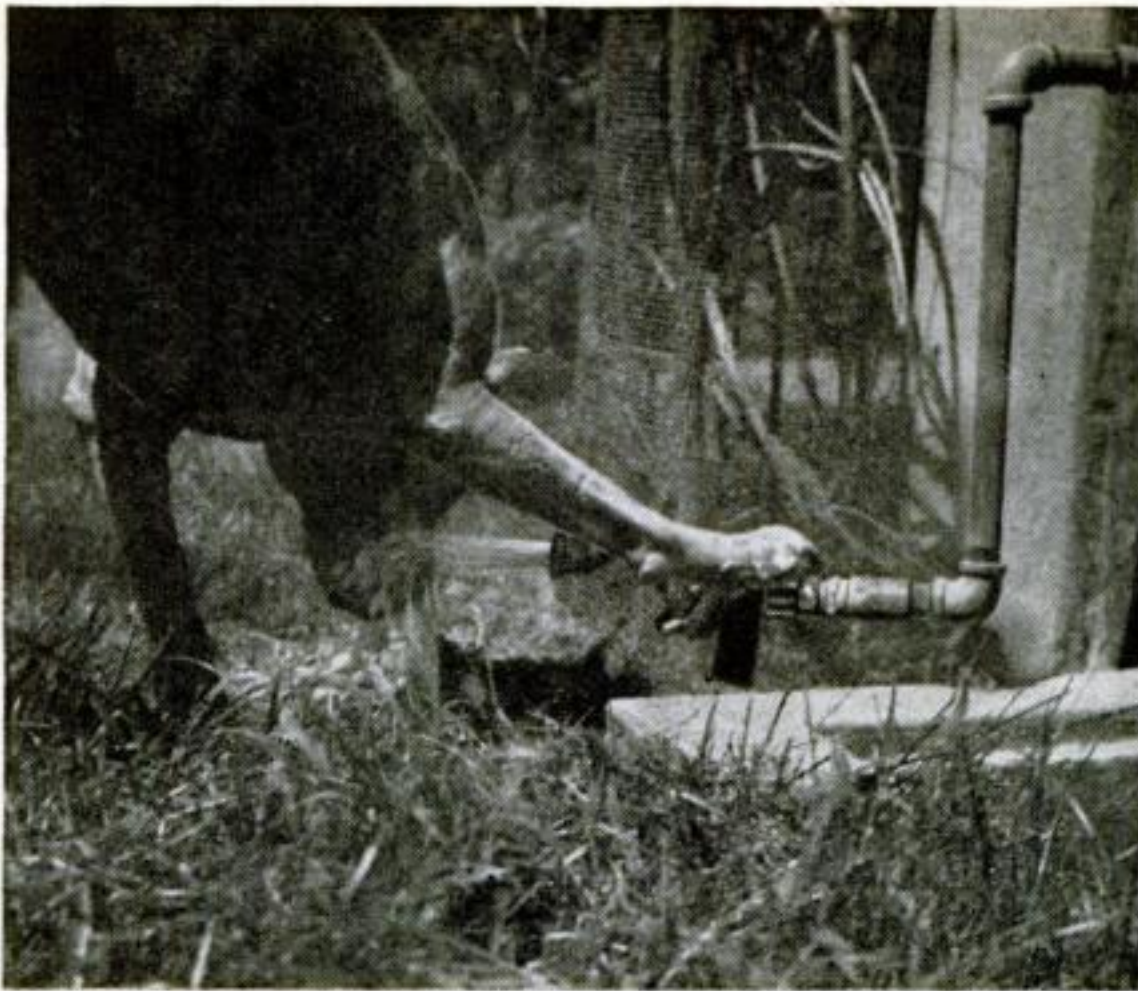
The sketch shows my spring-and-pulley rig. There's no reason a simpler system couldn't be worked out, based on the one used for an ordinary folding garage door.





## Short Cuts and Tips

FROM PS READERS



### Drinking fountain for a thirsty pooch

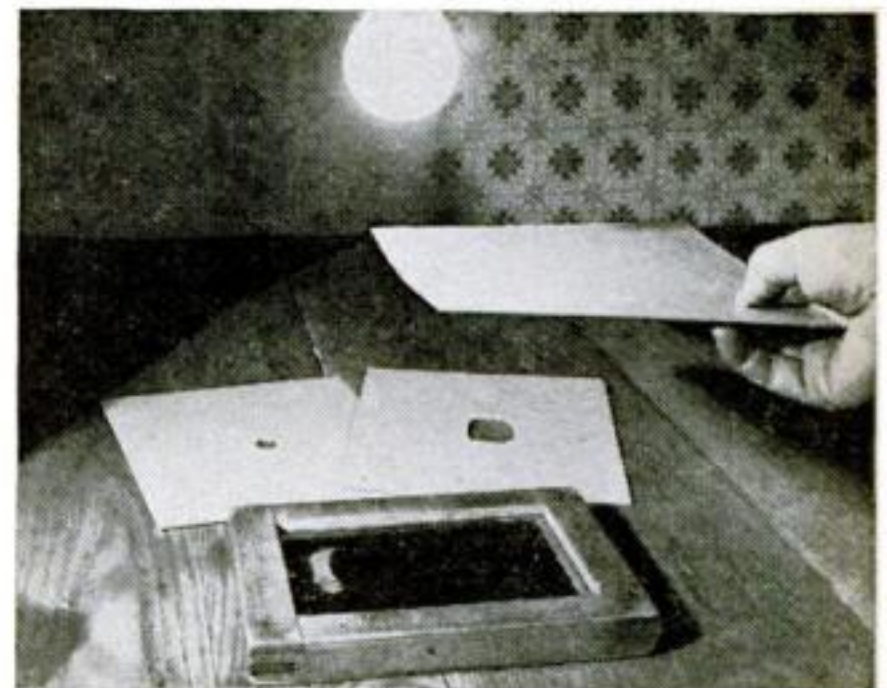
Our yard isn't littered with a lot of rusty water pans—yet our boxer never bothers us when he's thirsty. He ambles over to his personal drinking fountain and serves himself. Just a few pipe fittings attached to a

sill cock bring a spring-loaded lever faucet within paw's reach. I added two elbows at the end to reduce the faucet spray to a steady flow.

Training the dog to use his fountain was easy. We just put a little extra salt in his food.—*D. M. Norton, Columbus, Ind.*

### How to improve your contact prints

When using an enlarger, most photographers dodge and burn in areas of the negative that aren't perfectly exposed. You can do the same thing with contact prints from good-size negatives. Place negative and paper in a printing frame and make the exposure with a bare bulb. Control the light source with a card, as shown (right). A solid card will hold back areas that require less exposure; cards with holes of various sizes can be used for burning in parts of the print that need more exposure.—*Wayne Floyd, Fayetteville, Tenn.*



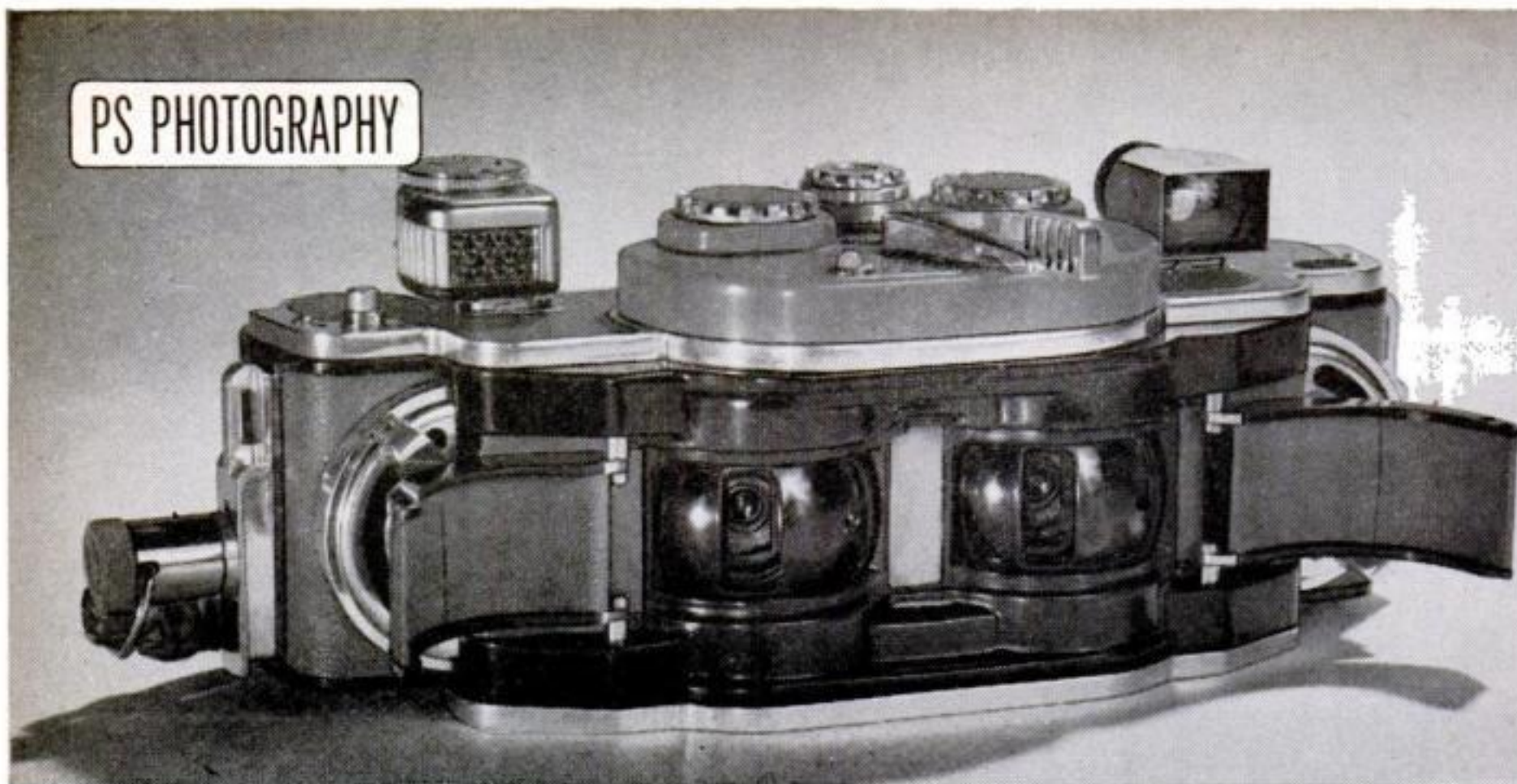
### No-figuring way to find a circumference

Rusty on your math? You don't have to remember the value of pi to find the circumference of a circle. This simple layout



gives you a straight-line solution that you can measure with a ruler. Draw a horizontal line tangent to the circle, and lay off point B at a distance from A equal to three times the diameter. Set a compass for the radius of the circle and, with the point at C, strike intersecting arc D. From D, draw a line parallel to AB, to meet the vertical diameter at E. The length of line EB will be within a hair of the circumference.—*M. W. Loftus, Chicago.*





Twin lenses pivot during exposure to scan a 120-degree field. Speed of scan determines the

effective shutter speed. Film is curved in an arc, center of which is at lens' pivot point.

## New Roving-Eye Camera Gives 3-D...and Then Some

**W**HEN you push the button on this new stereo camera, it rolls its "eyes" around to record a 120-degree view. A companion transparency viewer has pivoting lenses so that you not only see your pictures in three dimensions, but you can look around in the picture scene just as you

would if you were in the actual scene.

You can't buy it yet. So far, only a few expensive prototypes have been built. However, a peek into the viewer at a scene photographed by this remarkable camera, is enough to convince even the skeptical that here is something special: the makings



Viewer projects images from the curved film onto the retina of the eye to duplicate the images you would receive if you were looking at the natural scene. Thus your brain is tricked into believing you are looking at the original scene. Lever on top of the viewer swings lenses to let you look around in the scene, giving a greater sense of reality.

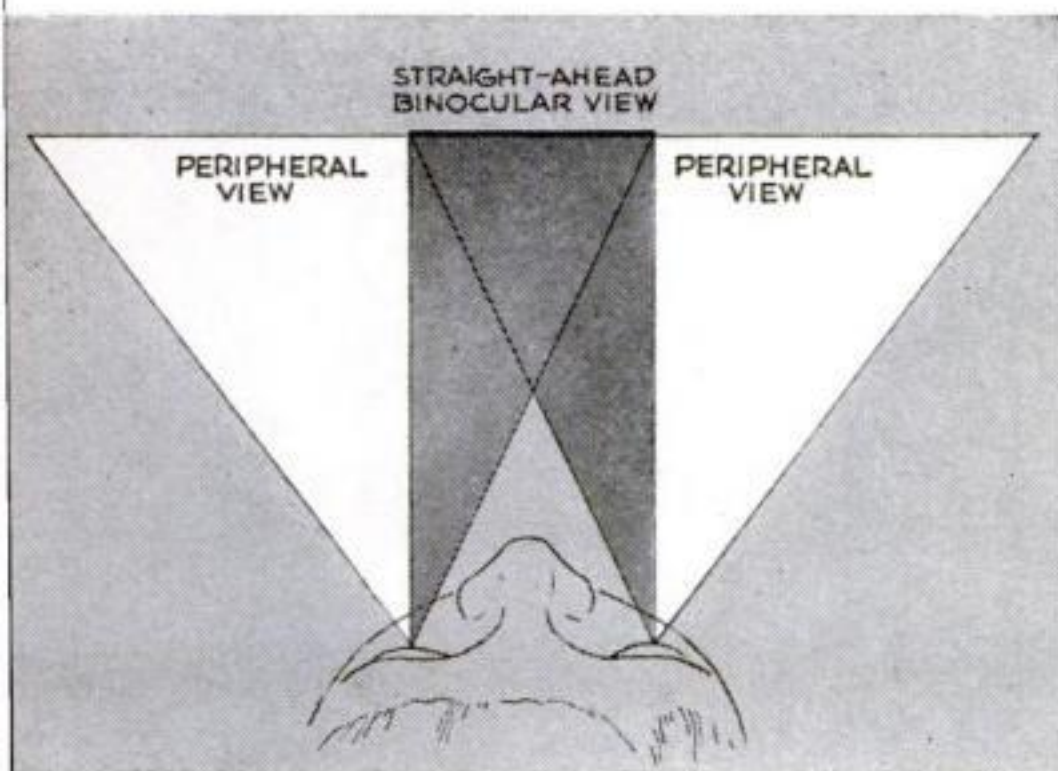


of a new rage in amateur photography.

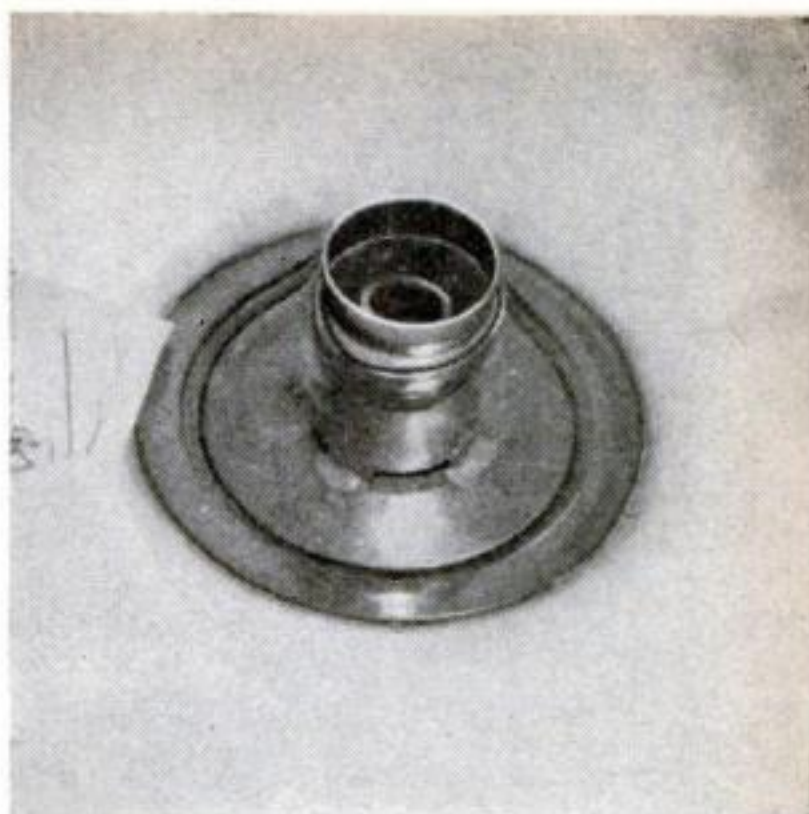
This new concept in stereo photography, originated by Robert V. Bernier, duplicates both aspects of the way you normally see things in real life—using binocular and peripheral vision. With ordinary stereo pictures, you view a scene as though you were looking out a window; only the center of your field of vision is occupied by the picture. With this new system, the image that falls on the retina of your eye is exactly the same as the one you would receive if you stepped into the original scene. When you look straight ahead, you are conscious of the scene extending in all directions, even though you are concentrating on what's in front of you. If you want to look around, as you would when viewing the real scene, there's a lever on the viewer that swings the lenses to let you scan the view.

The secret of this amazing new camera is twin rotating lens spheres. Each lens is mounted in an opaque plastic ball that has one slit in front of the lens and one behind it. Lens, ball, and all rotate about a vertical axis during exposure. The rear slit acts as a focal-plane shutter. Standard 35-mm. film is held in a curved shape during exposure and viewing.

The camera has been developed over a period of five years at Globe Industries, Inc., Dayton, Ohio. Bernier says that an amateur version of the camera could be put on the market for about \$65. The decision has not been made yet as to whether Globe will manufacture the camera or license it to other camera makers.



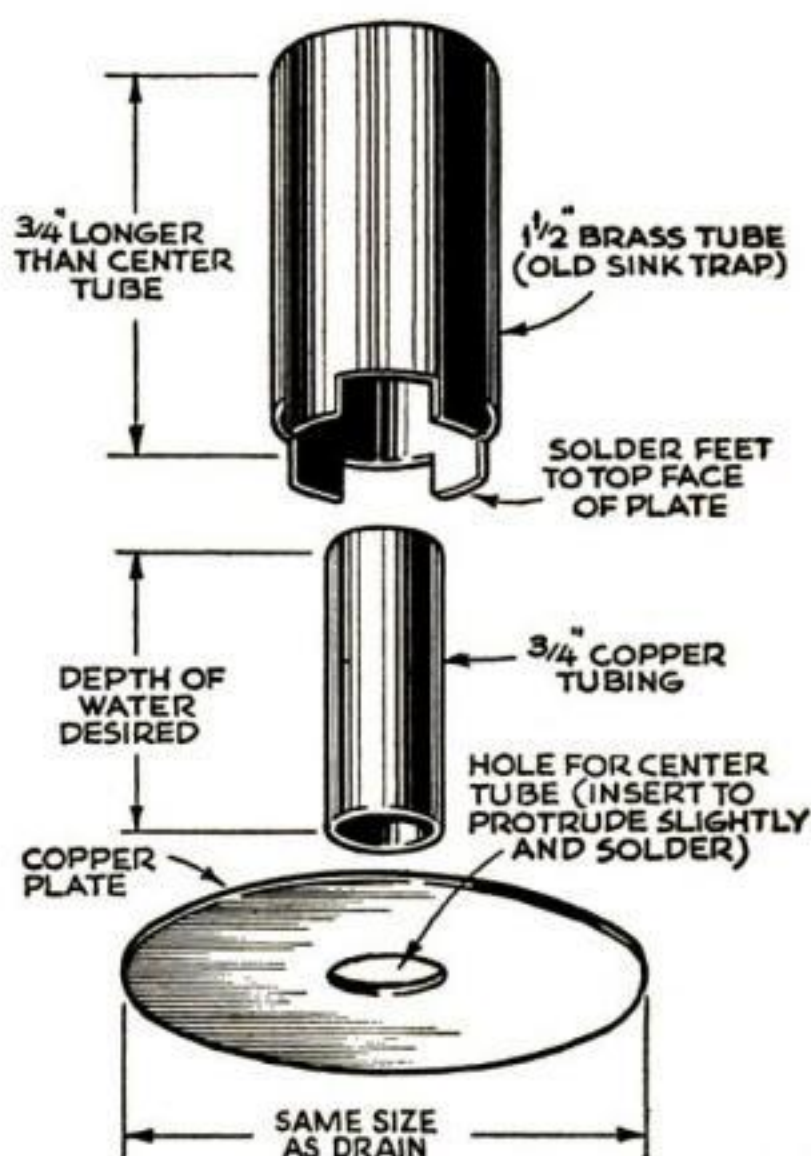
What you ordinarily see out of the corner of your eye—the peripheral view—has been missing in previous systems of stereo photography. Until now, stereo has worn blinders.



### Convert any sink for print washing

The trouble with washing prints in a household sink is that they tend to seal off the drain. Here's a guard that prevents this, and encourages a steady flow of the hypo-laden water at the bottom.

Make it of copper or brass. If you fit the disk to your sink drain and keep the edges flat, you'll need no packing or seal. A little leakage under the plate isn't critical. As you fill the sink, water flows through the openings at the base of the outer tube and rises inside it until it spills over the top of the shorter center tube.—Herbert Y. Moon, Orient, N. Y.



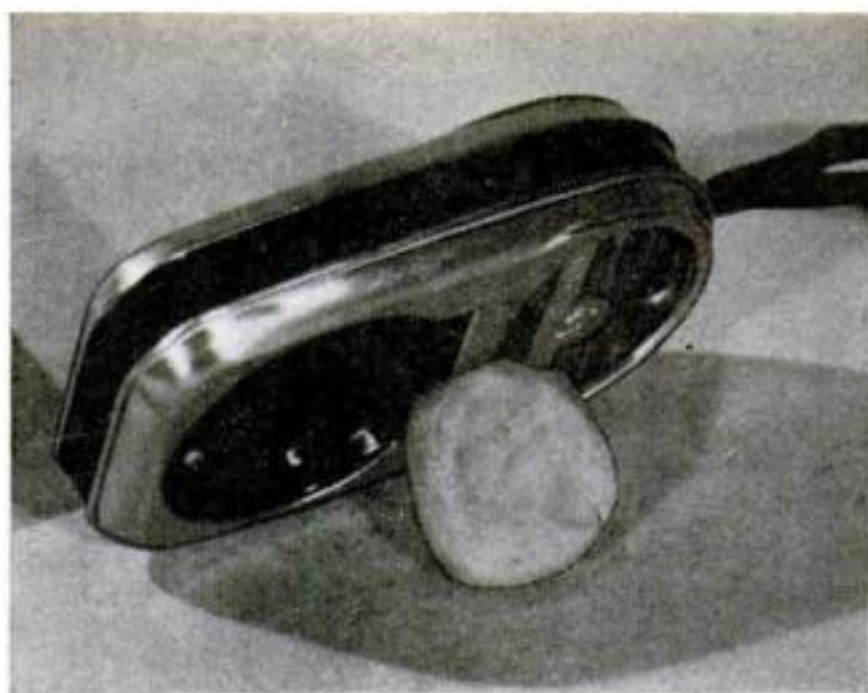


# Tips from the Gadget Bag



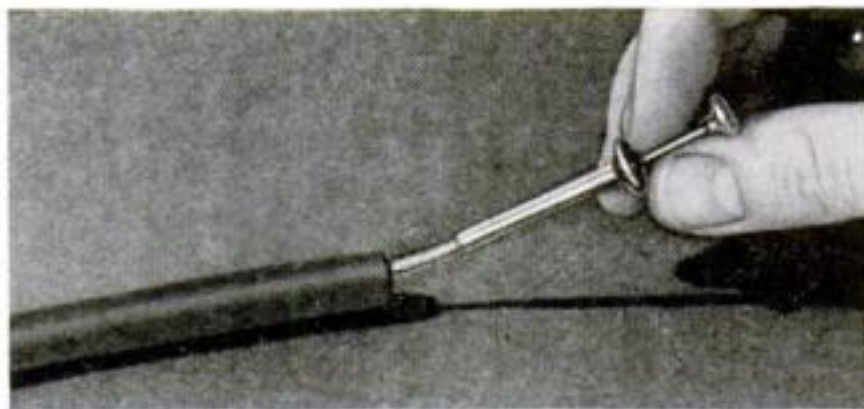
## Keeping your camera spick-and-span

Here's a handy addition to your gadget bag: that typist's eraser with brush attached. Use the brush end to flick dust off camera and case, and brighten the metal parts of the camera by rubbing the eraser over them.—*Ken Patterson.*



## Modeling clay makes a good anchor

Wrap a wad of modeling clay for toting in your gadget bag. It'll come in handy to prop up your meter or to anchor small objects you want to photograph outdoors. You can shape it to match any contour.



## Sheath for a cable release

Do you carry a cable release in your gadget bag? It'll last much longer if you keep it clean and protect it from sharp objects by inserting it in a piece of rubber tubing of the same length.—*Ken Patterson, Moose Jaw, Sask., Canada.*



## Rogues' gallery helps amateur barber

Like many parents, I bought a set of clippers to save money on the children's haircuts. Not having much confidence in my skill, I first sent my two boys to a barber shop. When they returned, neatly trimmed, I posed them for front, back, and profile portraits. Now, before I start barbering, I tape enlargements of these photos to a nearby wall so I can copy a professional's work.—*J. H. Matthews, St. Louis, Mo.*



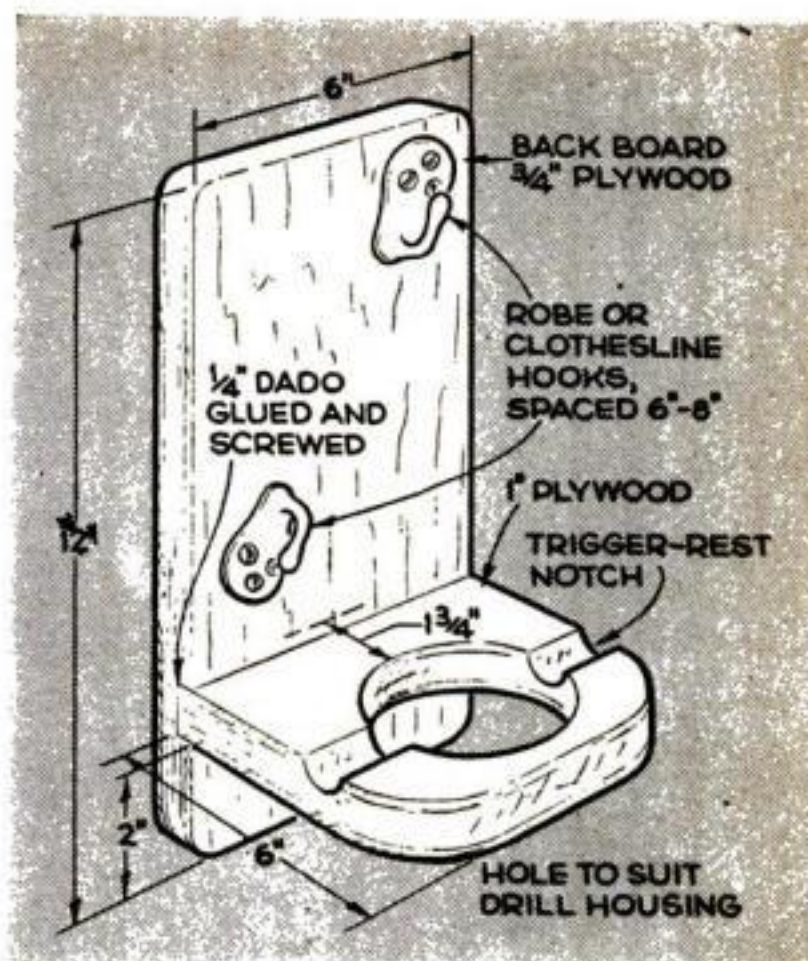


### Flashbulb tester is easy to make

If you're uncertain whether a flashbulb is good, don't take a chance. You might miss an important shot. Make this simple tester to carry in your gadget bag. Bend a length of stiff wire around a penlight battery. Fasten one end against the bottom with cellophane tape. Coil the other end around the threads of a one-cell penlight bulb, positioned so that you can butt the flashbulb against it while making contact with the centerpost of the battery. If the flashbulb is good, the other bulb will light. —Wayne Floyd, Fayetteville, Tenn.

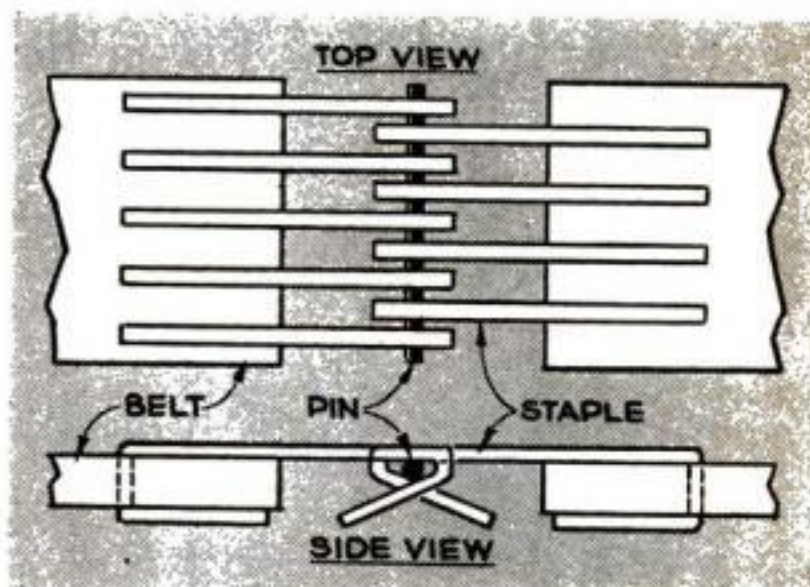
### Checking flash synchronization

Disappointed in your latest batch of flash shots? Maybe your gun and shutter aren't properly synchronized. If you use off-camera flash (electronic or regular), here's a simple check to see if you need repairs: After removing the back, aim the camera at the flash unit as shown. When you trip the shutter, you should see the flash through the lens. With flashbulbs, you may see an image of the bulb. This means you're getting only a portion of the flash—before or after the peak—and should have the camera checked. —Wayne Floyd.



### Drill rack from an English reader

Having been given some back copies of PS, I spotted the item in March '49 about a rack for a portable electric drill. I have built it, just to compare its safety margin with one of my own design (above), for which my employer awarded me £2/2/0 (about \$6). The drills in our shop were always being damaged by falls. They cannot be knocked from my wall-mounted rack if the power cable's wound 'round the hooks.—E. R. Payne, Winton, Bournemouth, Hamps., England.



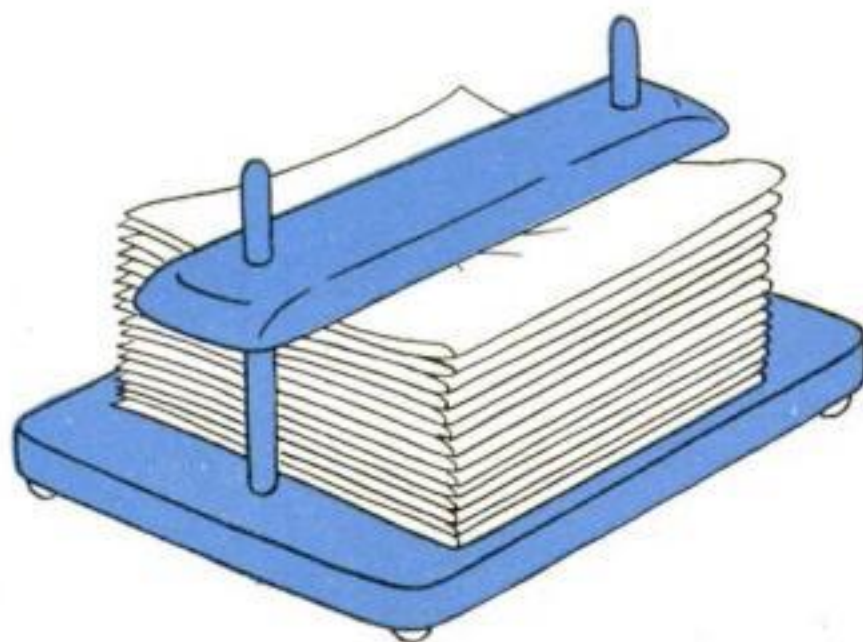
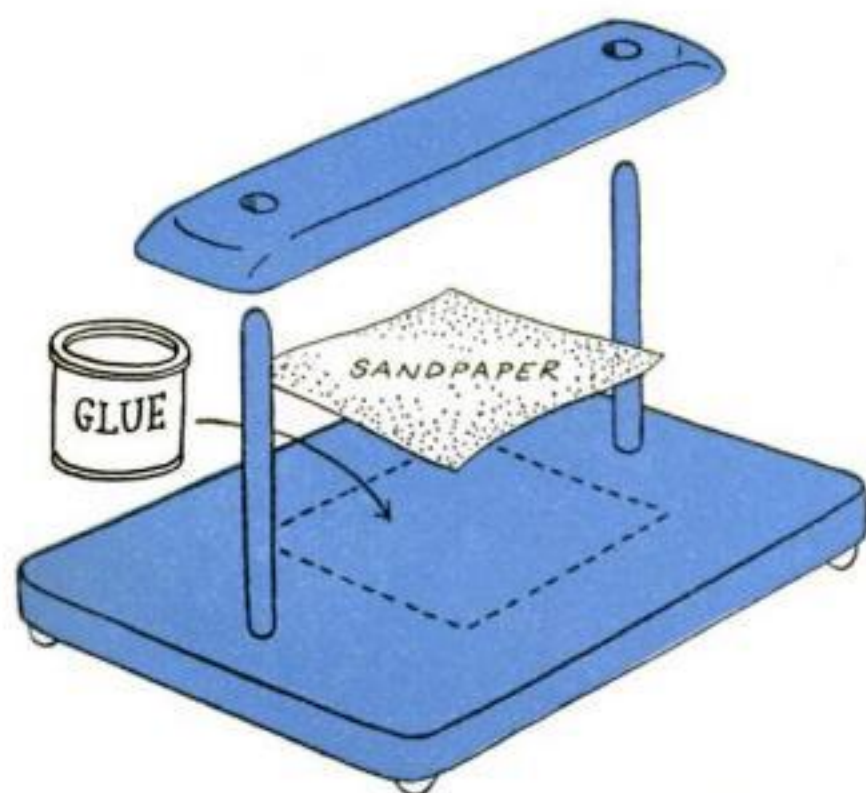
### Staples for miniature belt lacing

Need detachable belts for your models? You can simulate hook-type belt lacings with ordinary wire staples. Drive a row across each end of the belt, staggering locations so the free ends will mesh. Slip a pin (a length of plastic insulated wire) through the crimped hooks. They'll hold well under light loads.—William B. Rasmussen, Prosser, Wash.

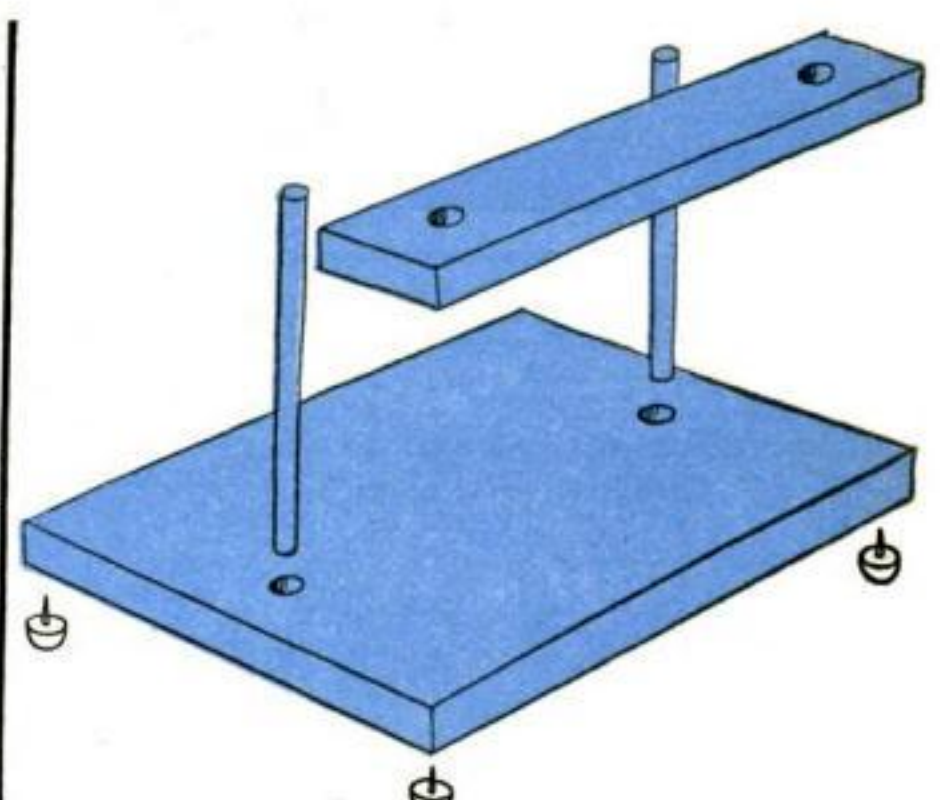


# Wordless Workshop

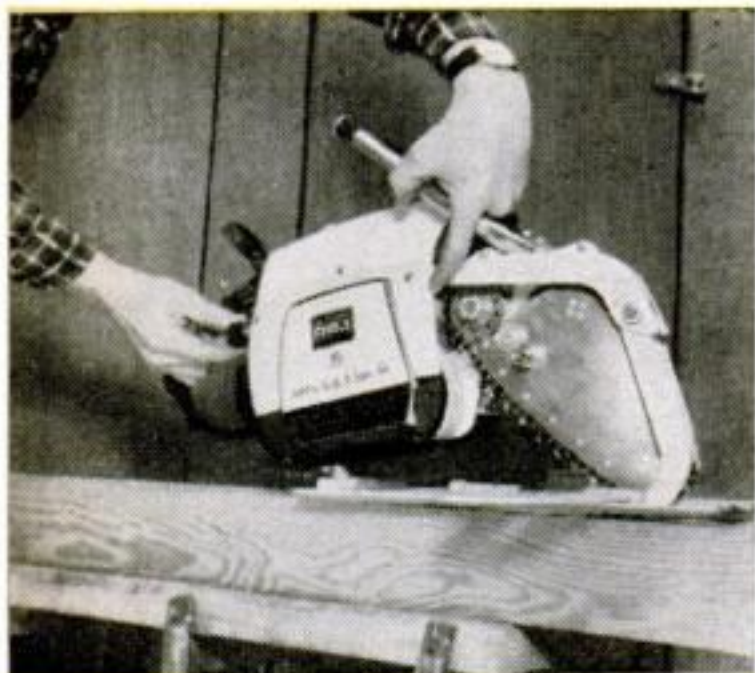
By Roy Doty  
and Jack Kenison



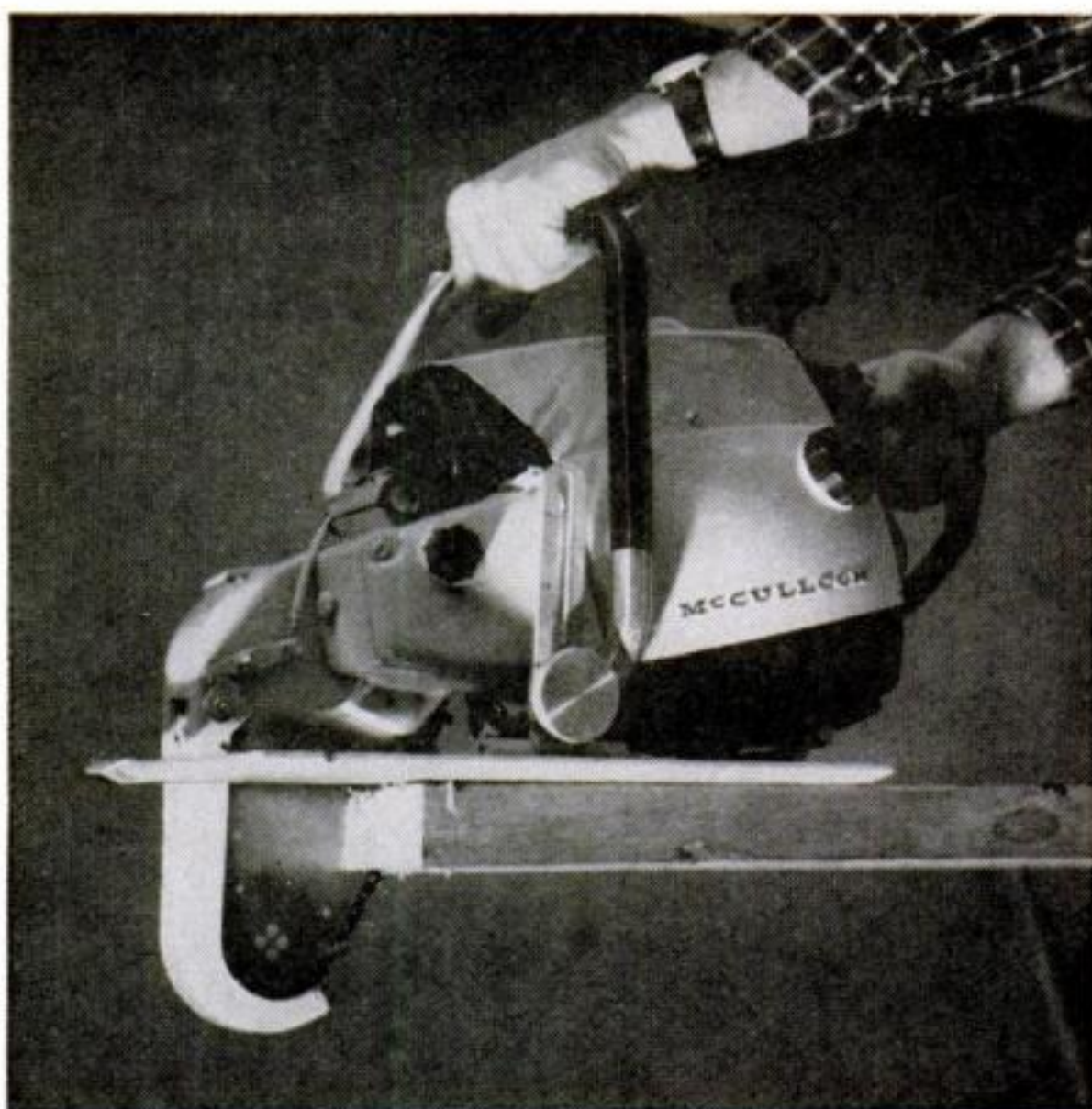
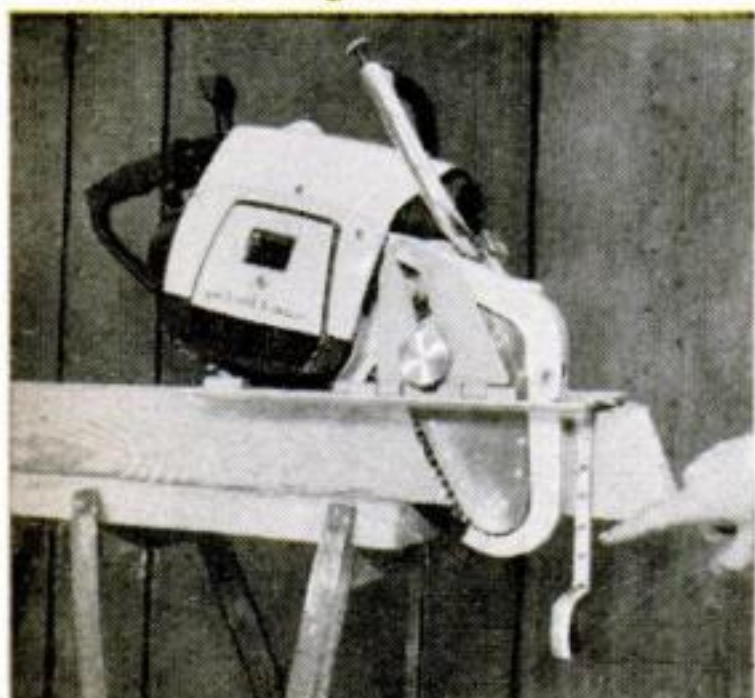






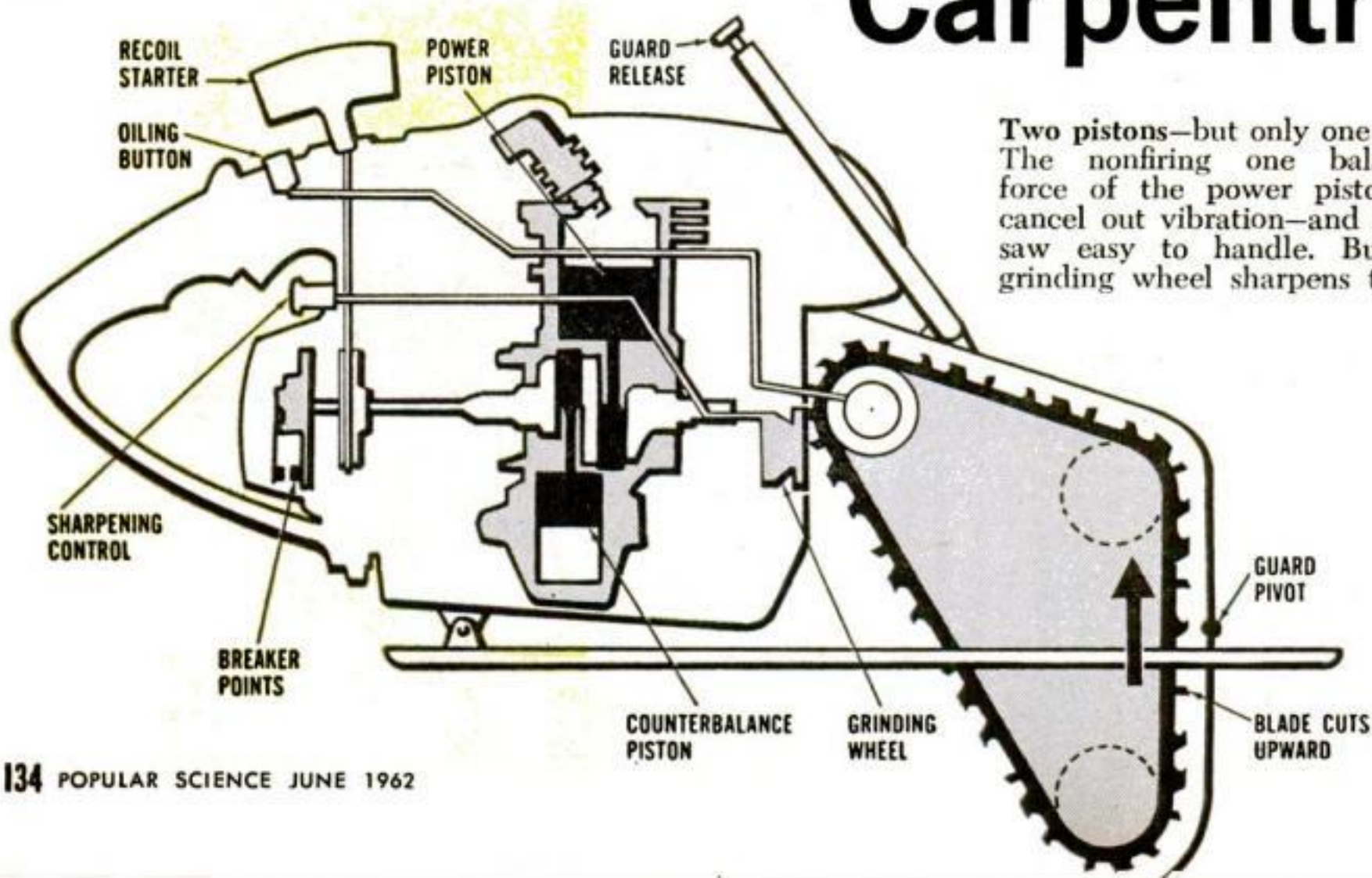


Entire engine and blade are pivoted at the baseplate, can be tilted backward for shallow cuts (above) or forward for deep ones (below). Fully extended, the chain will cut stock up to 4 $\frac{1}{2}$ " thick. The base of the saw can be removed for close-in cutting at obstructions.



Here's an entirely new tool:

# Vertical Chain Saw for Carpentry



Two pistons—but only one fires. The nonfiring one balances force of the power piston to cancel out vibration—and make saw easy to handle. Built-in grinding wheel sharpens teeth.





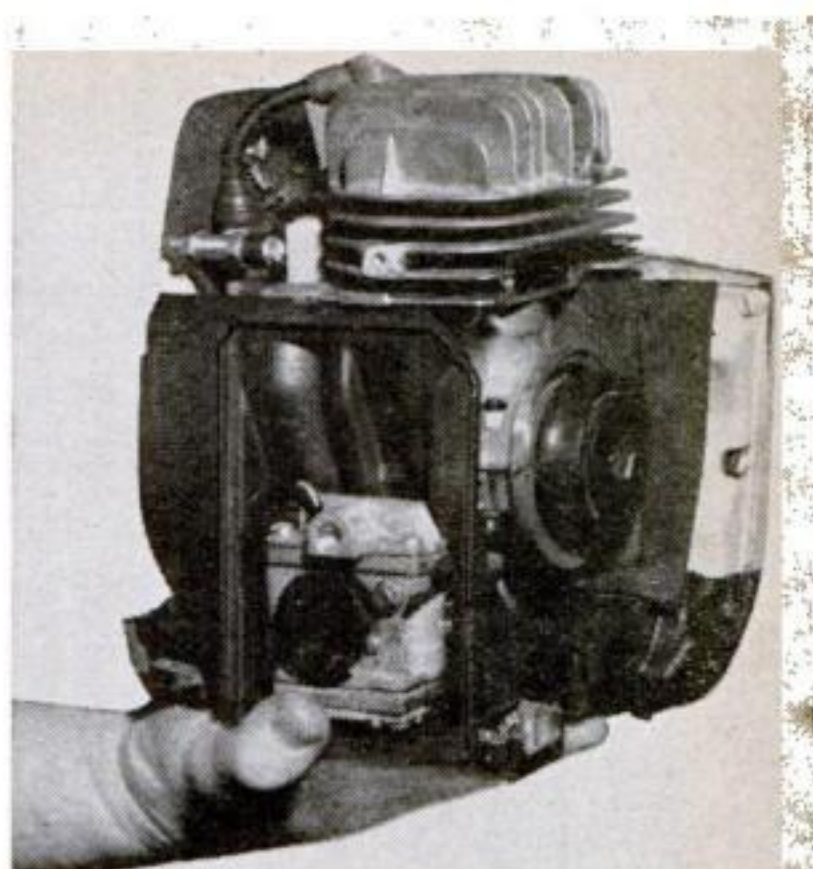
**By V. Lee Oertle**

**T**HEY'VE now put the rugged log-cutting qualities of a chain saw to work sawing ordinary boards. The result is a brand-new concept in portable cutting tools. The chain blade cuts straight up and down—at right angles to the power head instead of in the conventional horizontal direction.

You use the saw much like a portable cut-off saw, but with some notable differences. Maximum cutting depth is a whopping 4½"—enough to slice through unplanned 4" timbers in a single pass. Because the blade moves in a straight line, cuts come out clean and square, without the slanted overlaps produced by a circular blade. The saw is so powerful it takes only two seconds to zip clear through a four-by-twelve girder. It also tilts to make bevel cuts up to 2½" deep.

The new tool, dubbed the Carpenter's Saw, is a product of chain-saw-making McCulloch Corp. Gas-powered like its chain-saw cousins, it weighs only 21 pounds. You can use it in the back yard, up on the roof, out on a boat dock, or off in the country to build a summer cabin. Carpenters and construction men can pack it off in a car trunk to distant building sites with no worry over where the power is coming from.

**It sharpens itself.** Press a button and you feed a tiny built-in grinding wheel up against the



**Tiny nine-pound engine** is result of an odd fact: Added anti-vibration piston actually cuts bulk by reducing need for rigidity.

**Ever see a chain saw cut bevels?** New one at left chews off big bites by tilting like a cut-off saw. Depth at 45 degrees: 2½".



**Notching heavy timbers**, such as for stair treads, is one of many jobs made easy by vertical chain because cuts come out square.



**Plywood can be ripped** at rate of a foot a second. Edges of cuts are smooth enough for most general carpentry without further work.

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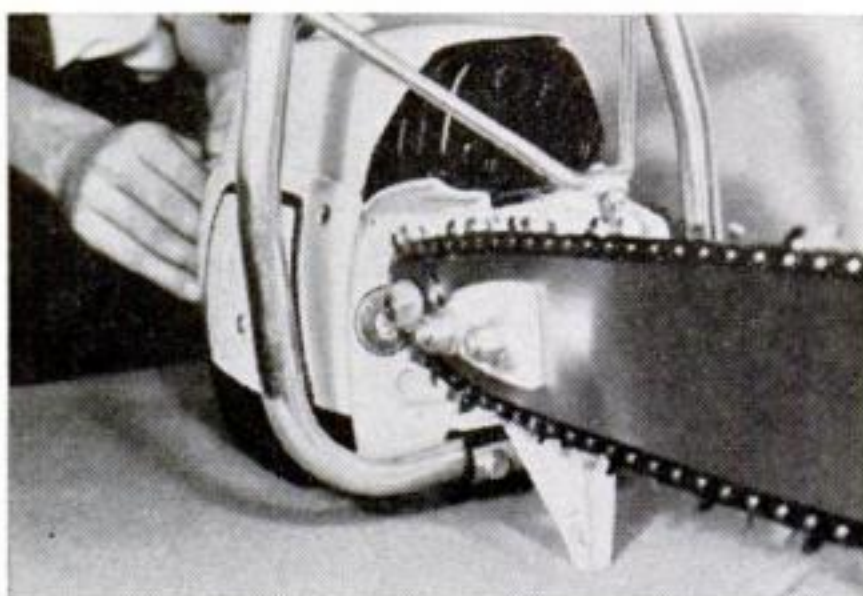
135



moving chain teeth, automatically keeping them sharp. Push another button and you pump oil to the chain for heavy cutting (this is in addition to oil normally pumped to the chain during regular operation). Still another button lets you prime the crankcase with raw fuel to give easier starting.

The self-sharpening feature permits the use of a clean-cutting upright tooth design, formerly hard to keep sharp. Its action is so smooth it's said to produce mill-finish cuts suitable for carpentry. Also, the chain rotates in the opposite direction from conventional chain saws, cutting upward instead of down. This pulls the base of the saw firmly down against the work so that the chain cuts cleanly.

Materials that have a good side are placed face down and sawed from the back so the upward-cutting teeth produce a smooth cut on the front.



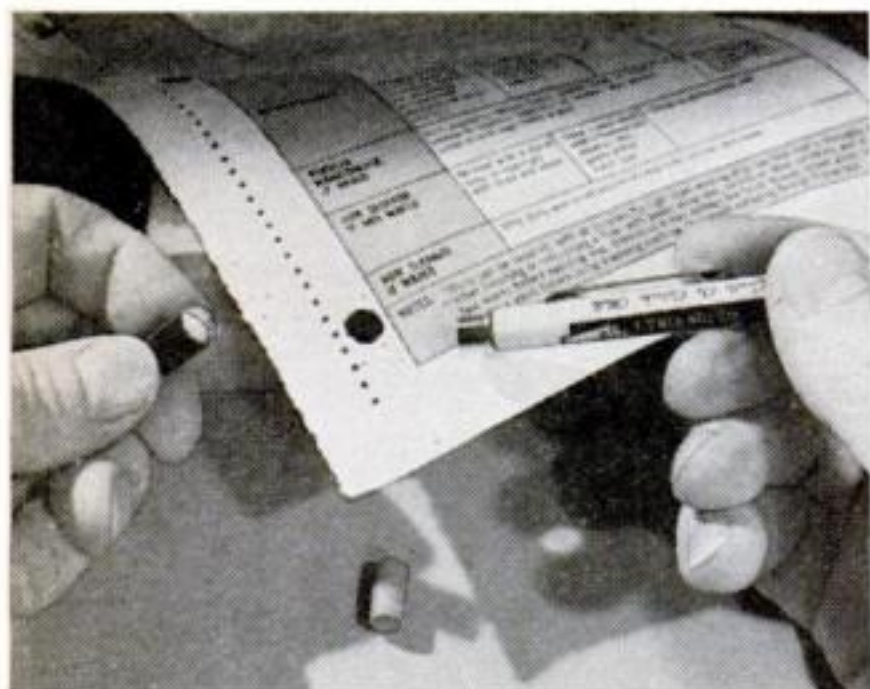
**New conventional chain saw**, also announced by McCulloch, is similar to vertical Carpenter's Saw except that chain is horizontal. It will be sold in 16", 18", 20", and 24" lengths.

*There's a hot new engine, too.* To go with its vertical chain, McCulloch has fashioned an unusual two-cycle engine with two pistons. What's unusual is that only one piston fires. The second piston, moving in the opposite direction, acts as a counterweight to cancel out the teeth-jarring vibrations normally found in one-lung engines.

The lack of vibration permits light construction and high cutting speeds, and saves wear and tear on the operator. The nonfiring piston is also used to compress the fuel-air mixture fed to the live cylinder. By doing this, McCul-

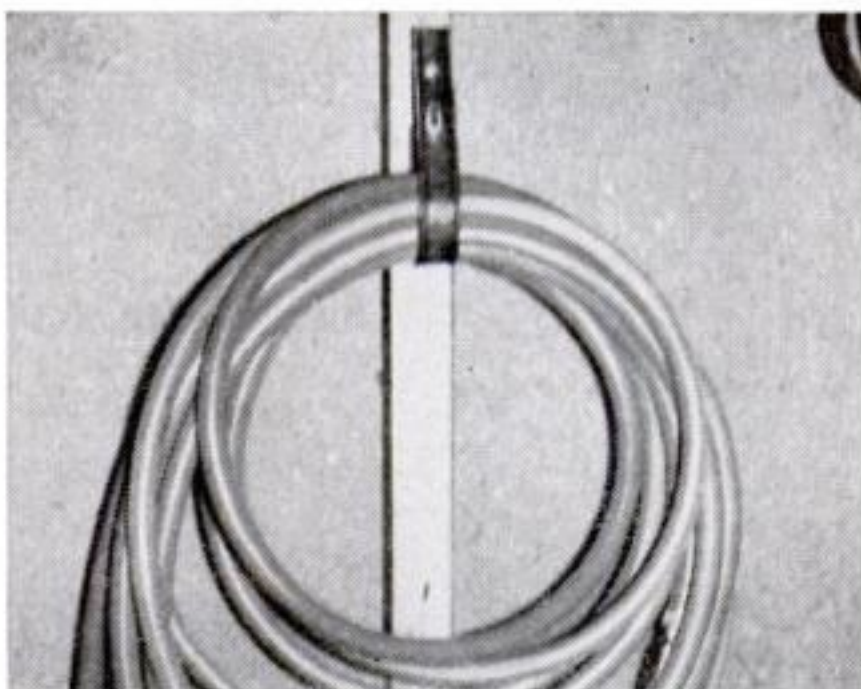
loch produces a supercharger-like boost in the power.

Price of the Carpenter's Saw, due for fall production, will be about \$350. A conventional-blade chain saw (pictured above), using the same new engine, will also be available. ■ ■



### Automatic pencil doubles as punch

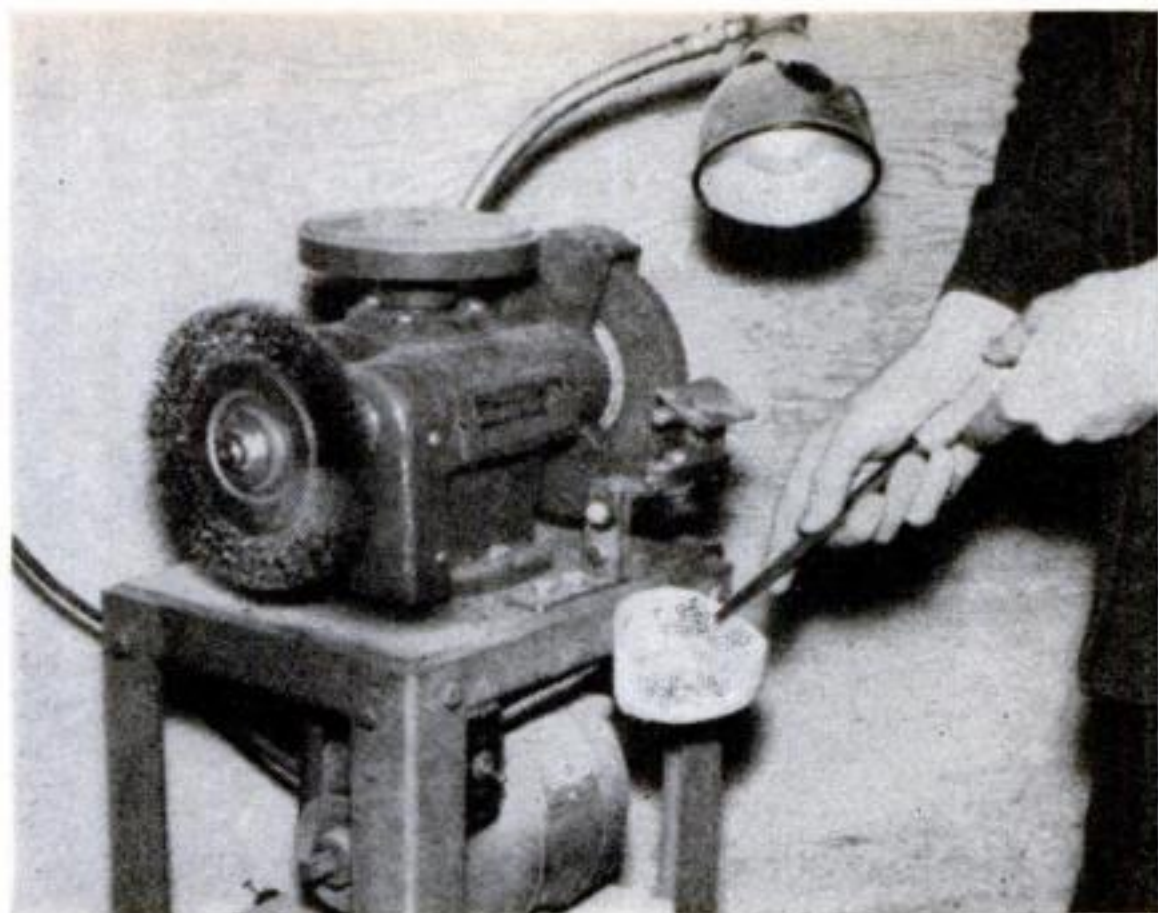
Ever want to file PS pages in a loose-leaf binder when there's no paper punch handy? You can use any mechanical pencil that has an eraser cap. Remove the eraser and press the empty well and the mouth of the cap together from opposite sides of the paper.—Ken Murray, Colon, Mich.



### Strap hanger for a garden hose

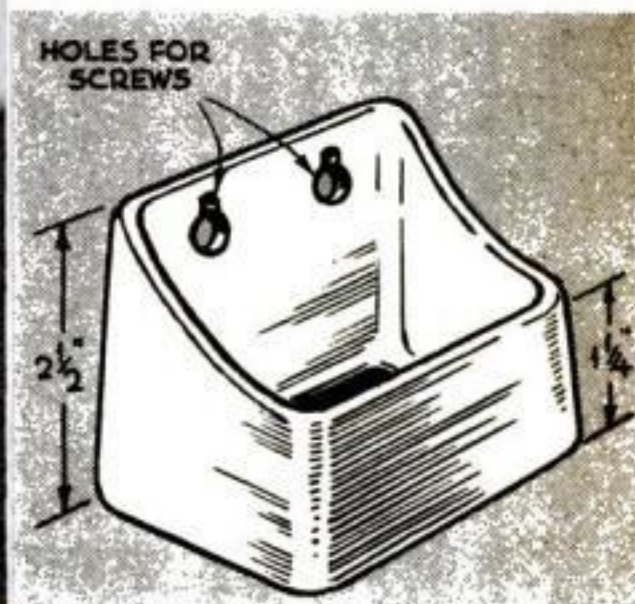
A neatly coiled hose becomes a tangle if it falls from its storage hook. I hang mine in a strap loop cut from an old belt. One end is nailed to a stud. The free end has adjusting holes with slits at the top to lock behind the protruding head of a second nail.—W. F. Chaple, Oklahoma City.





## Short Cuts and Tips

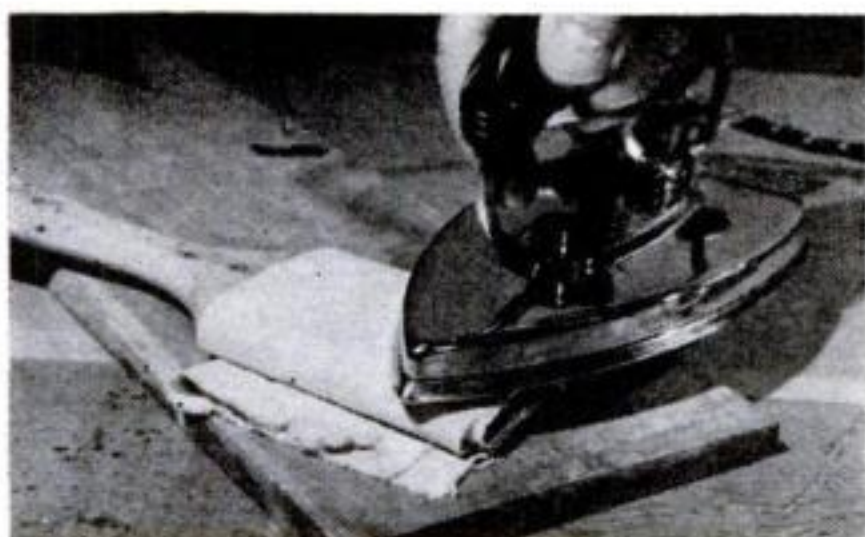
FROM PS READERS



### Water pot for a bench grinder

Snip the bottom off a plastic bottle—the kind liquid detergents come in—and mount it at the front of a wood or metal tool stand

with a couple of screws or bolts. It makes an ideal water pot: It can't be knocked off or tipped over, won't break or rust, presents no sharp edges to gouge you, and is easy to clean.—*Jack Kenison, Tacoma, Wash.*



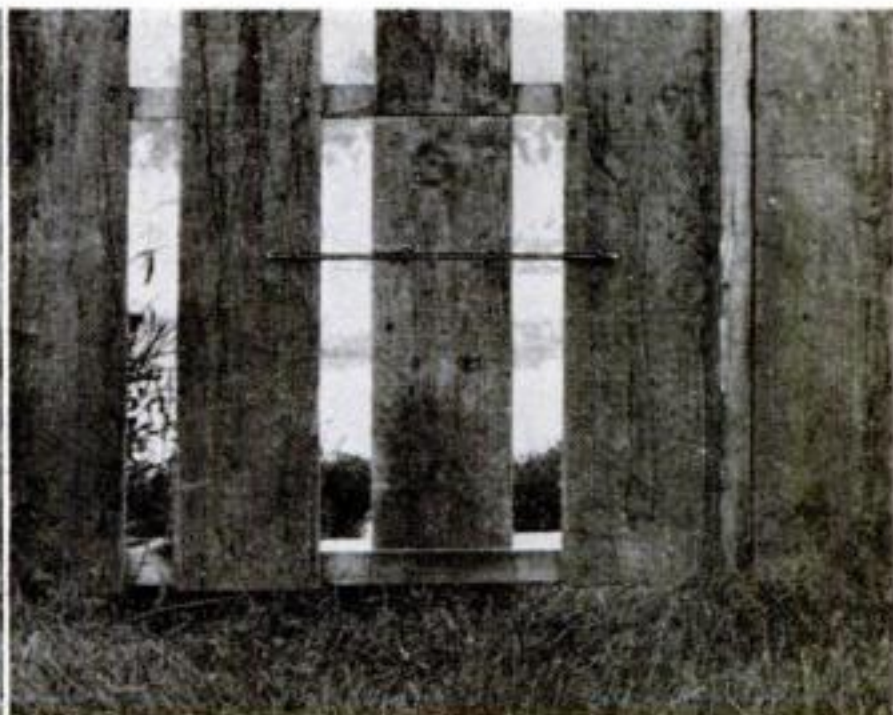
### Ironing straightens paintbrushes

When you poke a brush into corners or rest it on the bottom of the paint can, the bristles curl and stray. To straighten natural bristles (not synthetic ones), try wrapping the brush in a couple of thicknesses of damp cloth and pressing gently with an iron. The steam and cloth binding do the work; only a light pressure is needed. Let the bristles cool before you unwrap the brush and put it to work.—*Ken Murray, Colon, Mich.*



### Gate for a dog in back-yard fence

An inconspicuous private entry lets my dog pass in and out of our fenced back yard



while the "people" gates remain closed. I sawed through one slat and pivoted it on a stiff wire stapled above the center of gravity.—*W. B. Rasmussen, Prosser, Wash.*





Day or night, this marker identifies your home



Set beside a country driveway, redwood plank with raised reflective letters and border blazes when headlights strike it. Raised areas are surfaced with adhesive-backed Scotchlite.

# How to Make a Sign Like a Pro

By Bob Gilmore

A GOOD sign can save you a thousand annoyances. It may even help to save lives and protect your property. One that nobody can miss—at the foot of your road or driveway, beside your front walk, or at your door—will turn away strangers searching for the Smiths.

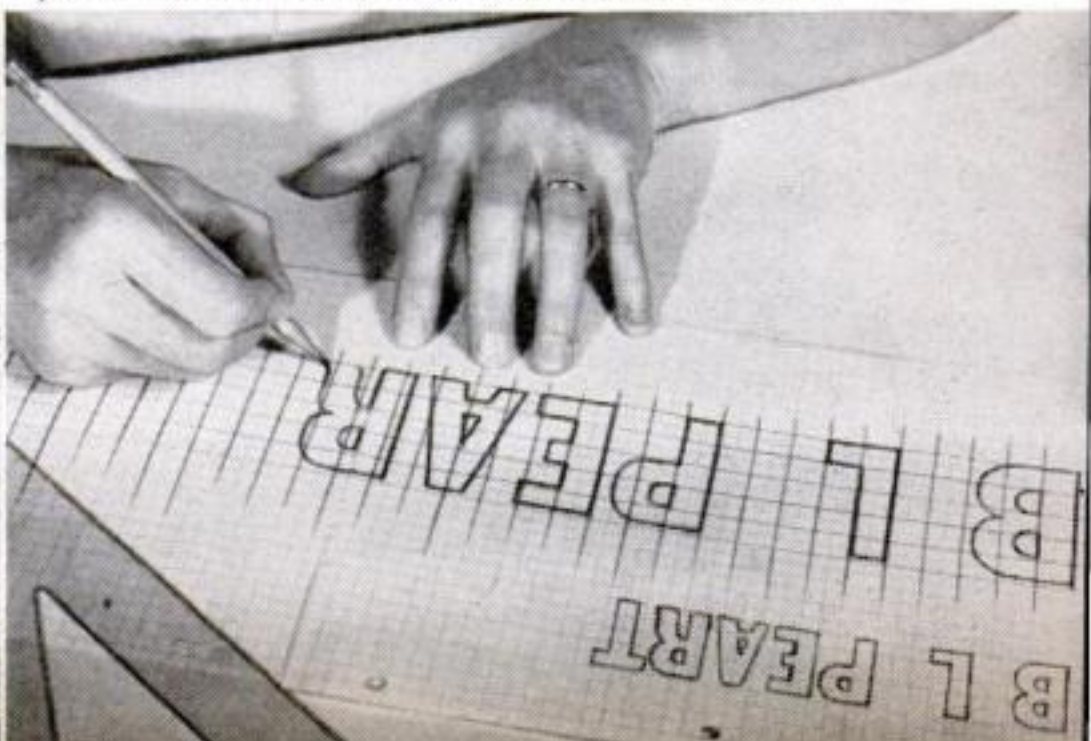
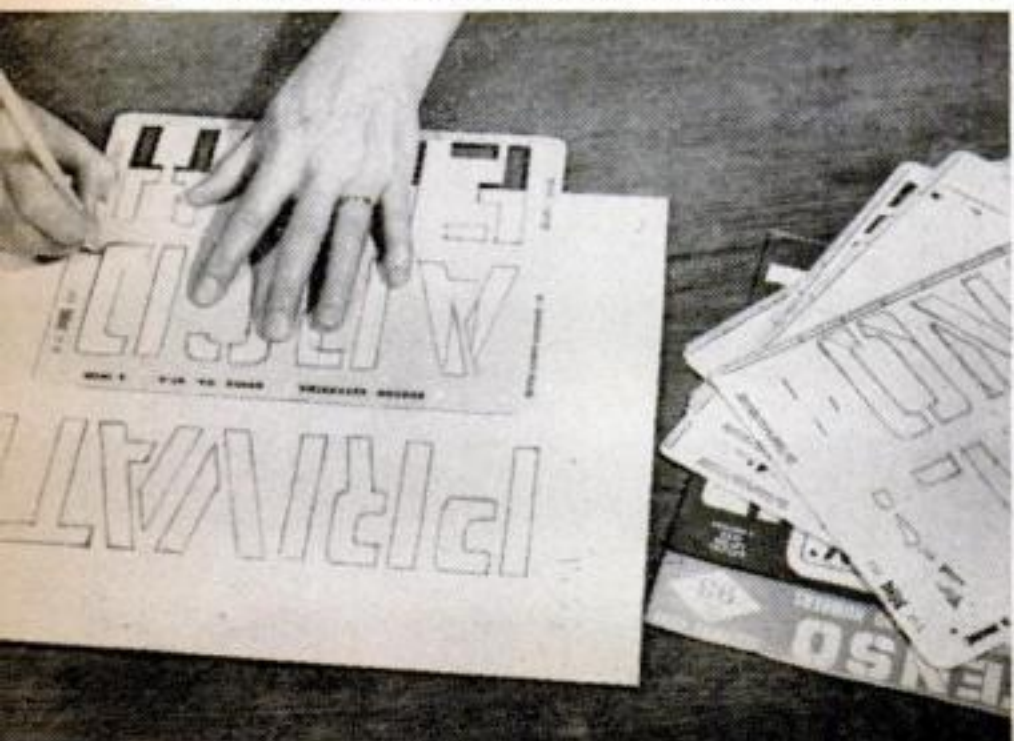
It can save you from drawing maps, and keep you comfortably indoors instead of shivering, sweltering, or dripping while you wait to convoy visiting friends. It can help doctors, firemen, or police find you fast.

A "Slow" sign can tame the teen-agers who hot-rod up your road. Hang out signs like "Private," "No Trespassing," or "No Hunting, Fishing, or Fooling Around" and you've buffered yourself against most of the human pests who intrude where they're not wanted.

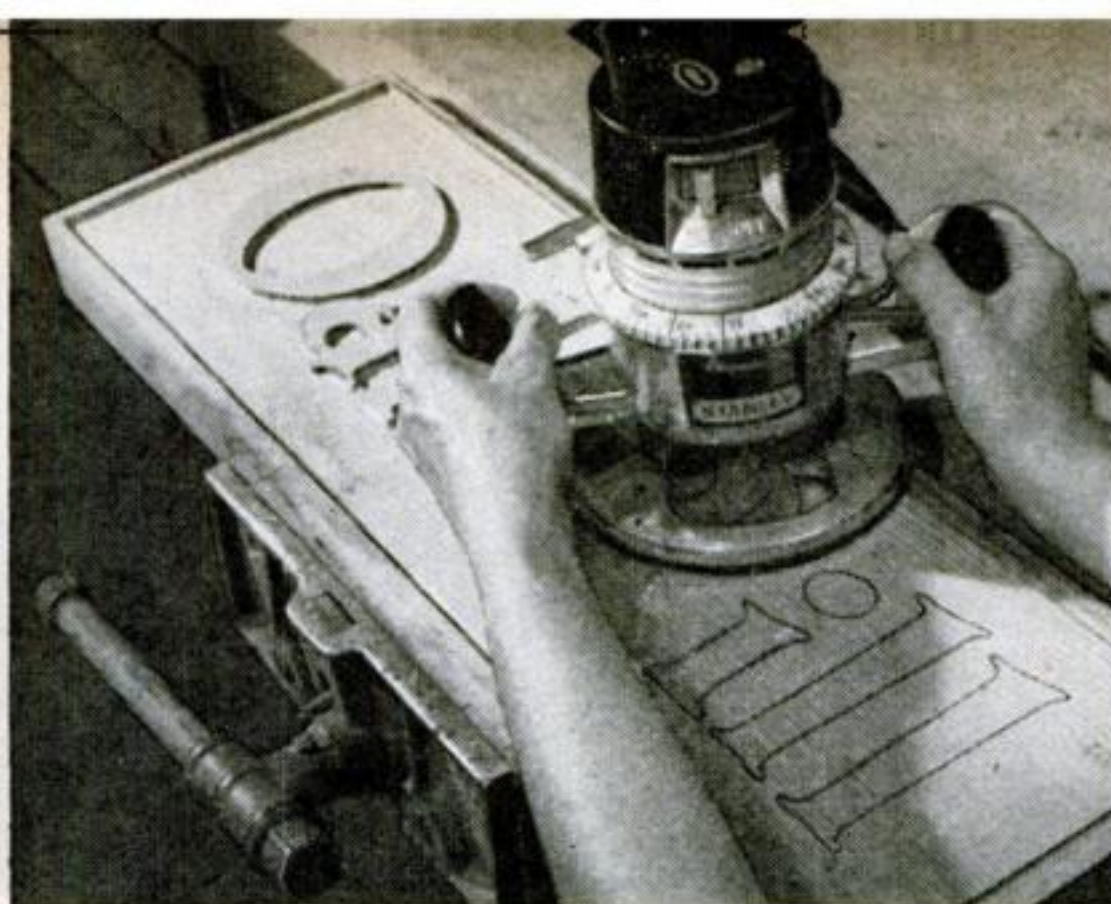
## Two ways you can lay out your own lettering

Cardboard stencils, in many alphabet styles, guarantee professional letters for hand-brushed, jigsawed, or scissor-cut signs. Use sharp pencil and space letters according to shape and bulk.

Graph paper helps you enlarge letters clipped from magazines. With carbon paper, trace them on small squares, then reproduce same part of letter in each corresponding larger square.







Hand-carved effect is achieved with round-nose cutter that forms curved fillet around base of letters. After routing outlines, remove rest of ground with random strokes. Apply clear sealer.



Drafting-tissue tracings from layout are rough-clipped and rubber-cemented to face of reflective sheet. Group tightly to reduce waste. Use stencil knife to cut hard-to-reach areas.

Such signs are duck soup for a professional. But you can make them, too, if you take pride in doing things yourself or if you like to save a few bucks.

Hardware and novelty stores sell different sizes and varieties of stamped-metal characters that nail in place. Art stores, stationers, and office-supply shops handle a wide selection of ready-made letters and numerals that will give your sign a printed or brush-lettered appearance: tough, flexible-plastic ones with adhesive on the back; decals; or a choice of brilliant colors in Scotchlite, an adhesive-backed plastic sheeting with glass beads and a mirrorlike background that blaze when light-struck.

If you can't find the kind of characters you want in the stores, letters and numerals clipped from magazine titles and newspa-

per headlines are another source. Trace them if they're large enough, or you can enlarge them with a pantograph or on graph paper. If you own a camera and enlarger, snap closeups and blow them up.

Whether you trace or enlarge the characters, or design them yourself, your imagination and the tools in your shop are the only limits to your choice of materials from which to cut them.

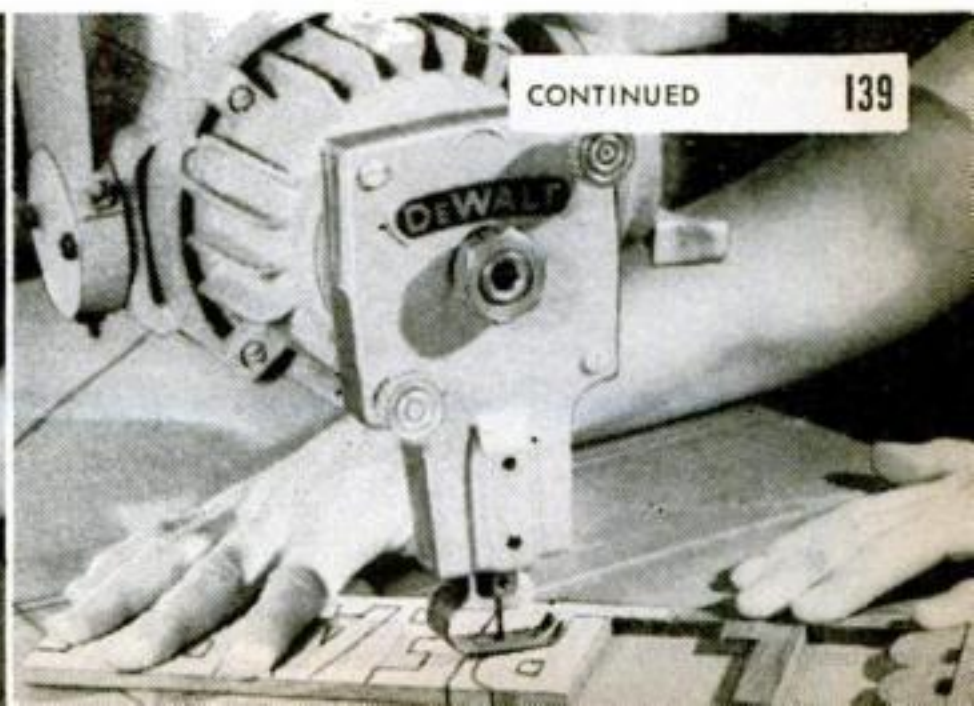
**Materials:** Scotchlite can be bought at some paint stores and sign shops in sheets 2' square or larger, colored silver, yellow, gold, blue, gray-blue, green, or red. It cuts easily with scissors or a sharp knife and sticks tight as soon as you peel off the protective backing.

Scissored letters of heavy aluminum foil will show up brightly by day or night, and

## With cutout letters you eliminate brushwork

Negative cutouts make stencil-like signs requiring no painting. Drill a blade hole in each area to be cut out. Hang panel by itself, or glue to a backboard of contrasting color.

Silhouette signs can be jigsawed from any flat material—even sheet brass. Below, wood-grained Marlite (a plastic-faced hardboard) is cut to stand in a grooved base on a mailbox.



CONTINUED

139



## Ready-made letters of various types simplify layout



**Pin-backed plastic** characters stay put when you press them onto a softwood board. After adjusting, lift and coat back with glue for permanent fix. Pinholes help reposition letters properly.



**Surface for decal letters** must be slick and waterproof. Lay them out dry; make location marks above and below; soak and slide them off paper backing onto face of sign panel.

are easy to stick down in a coat of tacky varnish or with cement.

If you enlarge your characters photographically, simply scissor or knife them from the printing paper. Use a heavy, glossy stock and, after mounting them on an appropriate background (light if the letters are black, dark if they're white), brush or spray on a coat of sealer.

You can cut thin vinyl letters from worn-out inflatable beach balls or animal toys. Cement the letters with the clear stickum that comes in puncture-repair kits for such plastics.

Wastebaskets or other containers molded from polyethylene will yield material for scissored or knife-cut letters stiff enough to be fastened to a background with tiny brass escutcheon nails.

**Sawing 'em out.** Thick relief characters can be jig- or saber-sawed from any material that's soft enough for these tools to cut.

Blades of high-speed steel will eat through thick sheets of soft copper or aluminum. Against the glass fibers laced through polyester-plastic sheetings like Alsynite or Filon, teeth will wear away and require several blade changes, but you can still jig out clear letters from such translucent stuff.

Ordinary blades will slice through tempered hardboards, hard-plastic counter-top

laminates, thick or thin acrylics, phenolics, wooden boards, or exterior-type plywood.

Rustproof nails can be used to fasten all of these jigged-out letters to backgrounds. Drill pilot holes first to permit nailing through the harder materials and to prevent denting, splitting, or chipping in the softer ones. If you don't want the nails to show, or if the background can't take them, contact cements will fasten the letters. Waterproof wood glues will hold the porous ones; epoxy adhesives stick all types.

Hardboards, wood, and plywood need protection against sun and storm. Seal by coating thoroughly with paint or plastic sealer. Lay it on in several coats—especially around plywood edges.

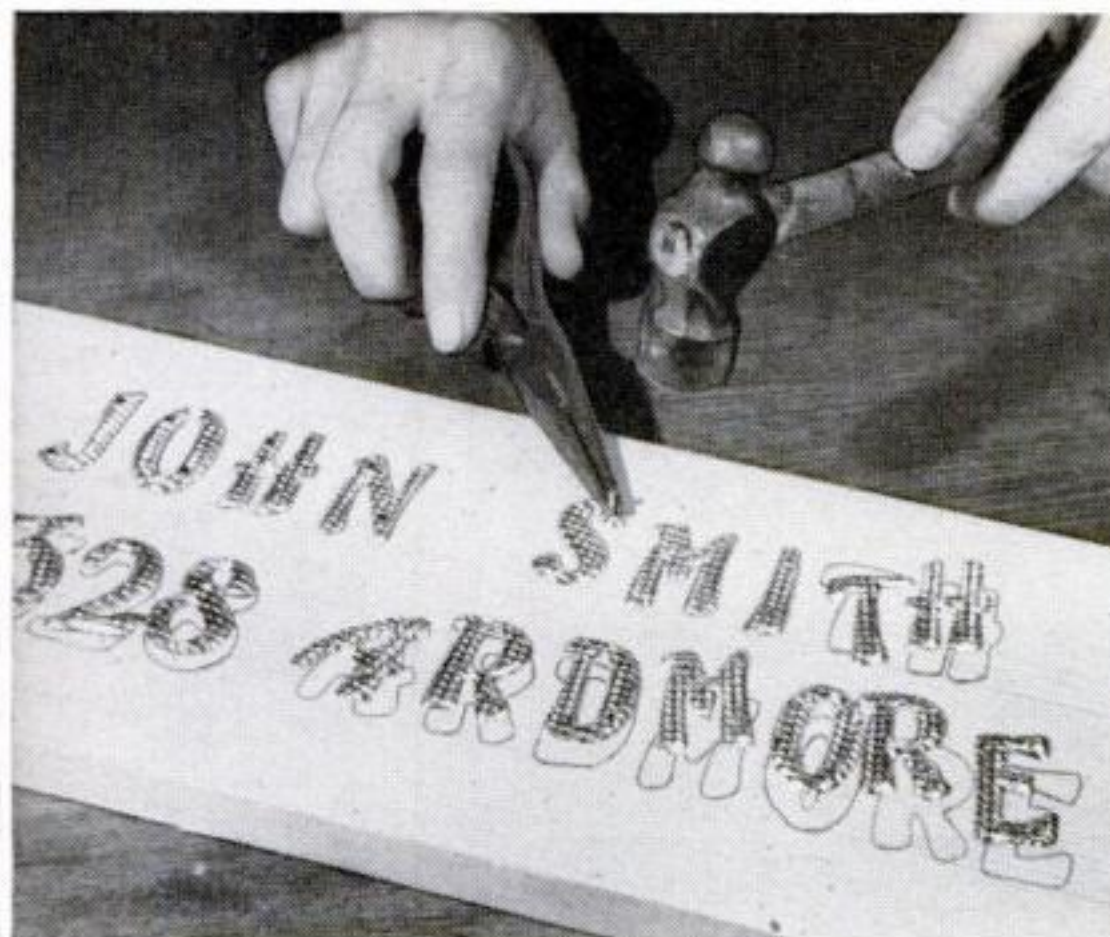
Silhouette signs, or signs that are just the opposite—with spaces cut out of a panel—can also be jigged from these materials. You can hang them without a background, fasten them against a panel or wall of contrasting color, or jig duplicates from sandwiched panels and fix one to each side of a solid center panel to make a sign that will tell its story from two directions.

**The personal touch.** Unique, stylized signs to match your personality or that of your home can be created in several ways if you've the time, patience, and skill.

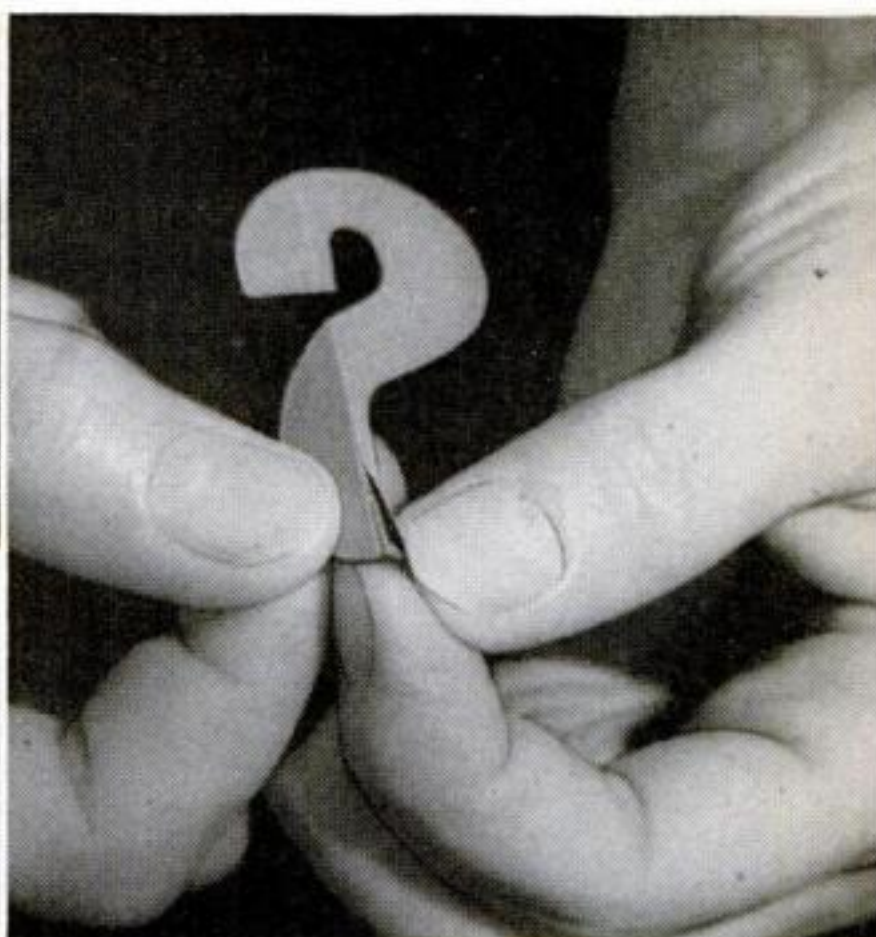
For a beach home or summer cottage,



to give you a finished sign in a jiffy

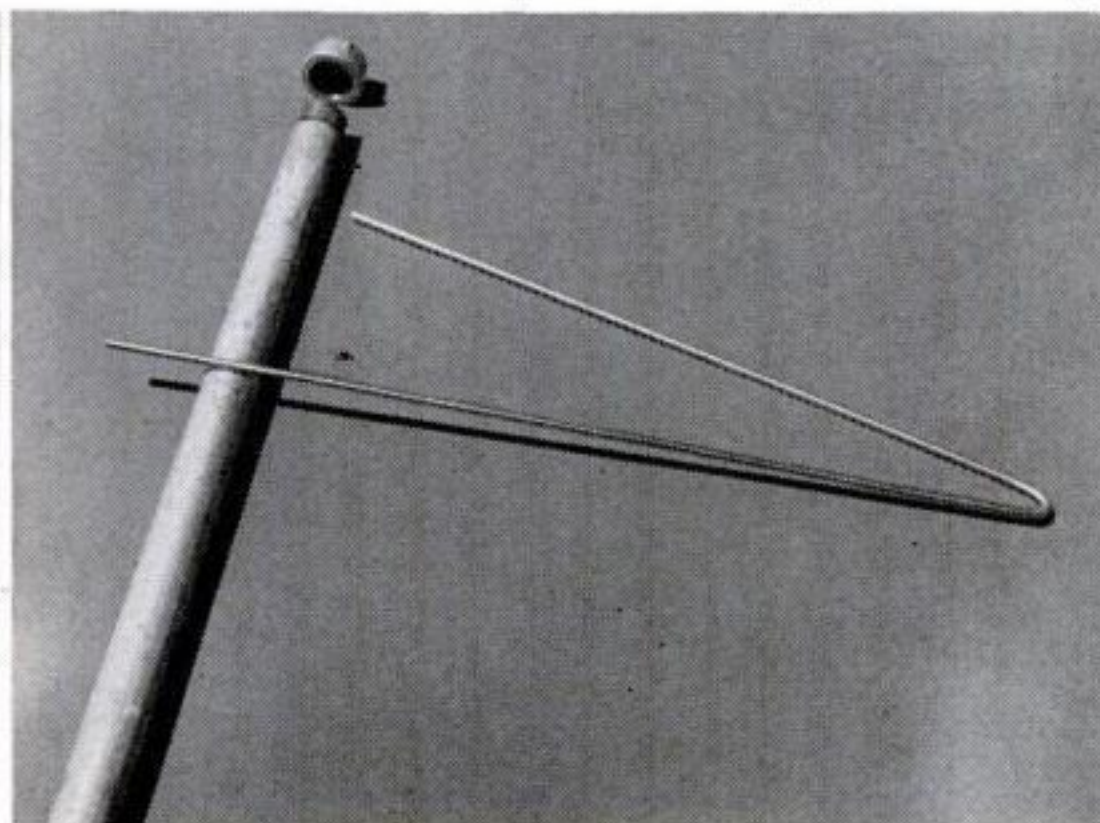


**Cheap stamped-metal letters** have embossed diamond pattern for high reflectivity. After lay-out, trace around each character for position. Nail, using tack hammer and long-nosed pliers.

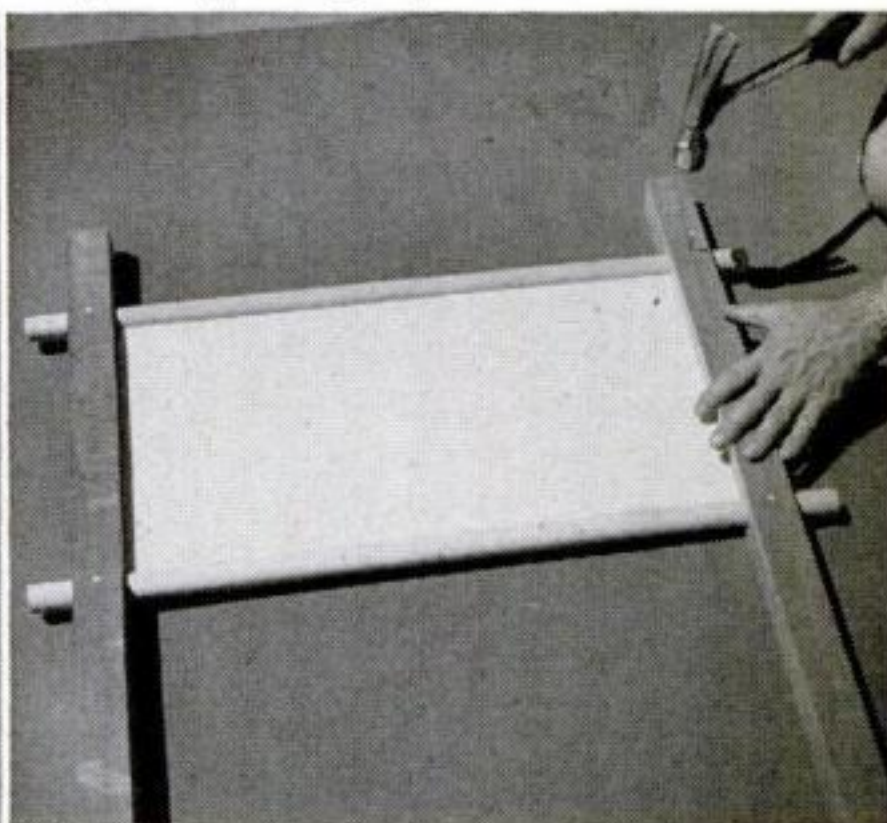


**Reflective-sheeting characters** can also be purchased ready-made. Paper backing is slit for easy peeling, but care is still needed to avoid tearing. Lay out the sign before peeling.

## A choice of posts when you're ready to put up a sign panel



**Suspended-panel post** is made from 1½" galvanized pipe, cap for top, and ¾" steel rod. Drill pipe, insert horizontal leg of "hairpin" through until top leg touches pipe. Weld joints fast.



**To frame thin panel** such as fiber-glass or hardboard, insert large kerfed dowels between redwood uprights (also kerfed, between dowels). After assembly, drive brads into dowels.

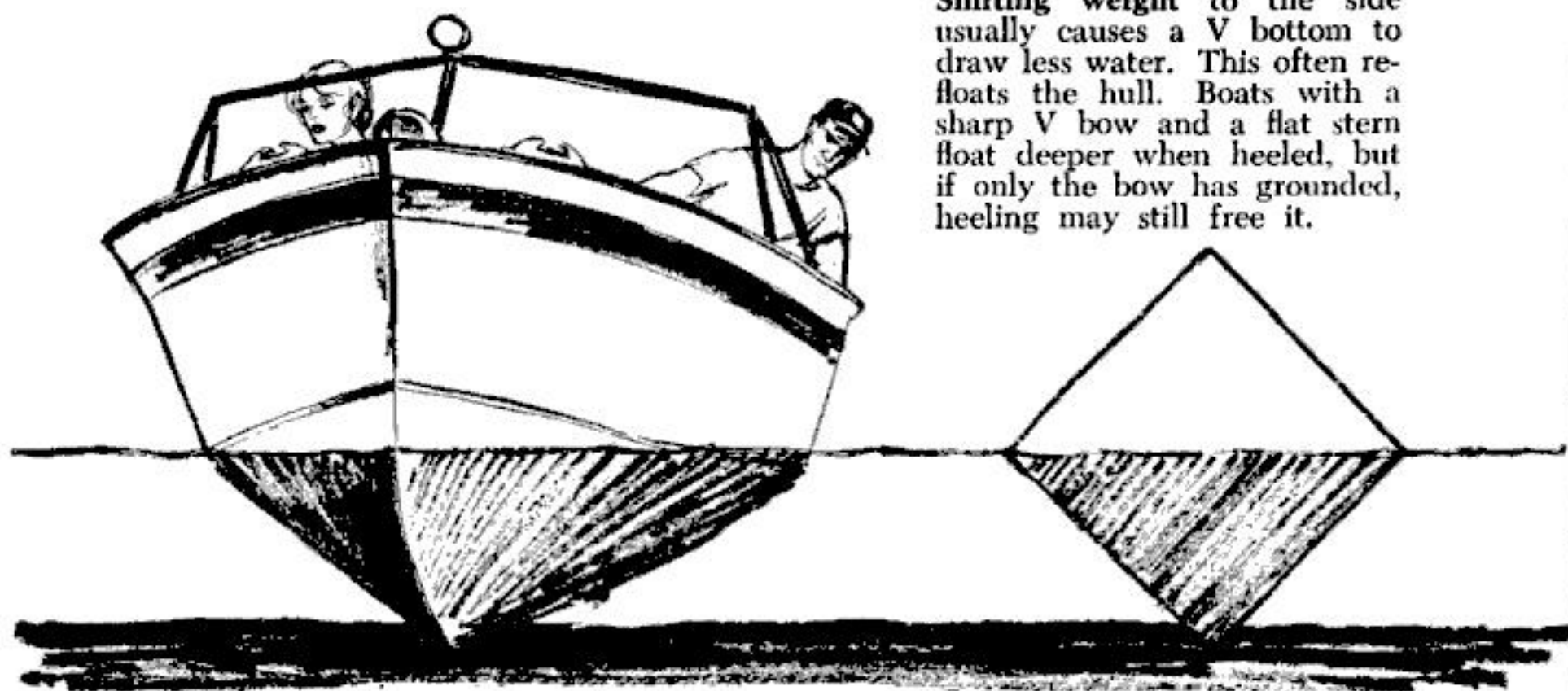
Manila, nylon, or polyethylene rope can be bent to form letters or linked script that you tack to a board background. Heavy copper wire, or thinner wire with thick neoprene or vinyl insulation, can be shaped and fixed to a wall, gate, fence, or signboard with staples.

Letters of a rustic character can be

shaped from straight and curved pieces of twig glued to a flat backing. Oriental styles are easy to create from bamboo. Or you can go way-out modern by bending letters from thin strips of sheet metal. Or way-back traditional by hand-carving or power-routing intaglio or relief letters of Roman or Old English style in old planking. ■ ■



Shifting weight to the side usually causes a V bottom to draw less water. This often re-floats the hull. Boats with a sharp V bow and a flat stern float deeper when heeled, but if only the bow has grounded, heeling may still free it.



# What to Do When a Boat Goes Aground

By George Daniels

**G**ROUNDING is deceptive. It seldom seems serious at first, yet in a typical season it claims more than a dozen lives and millions in damage. It's largely up to you whether the outcome is mere delay, a salvage bill, or a total loss. What you do—or, often, how promptly you do it—tells the story.

As soon as you hit, stop the motor to spare the propeller and keep out mud or sand. Get into a life jacket. If the impact was heavy, douse all cigarettes and take care of any spilled fuel.

Don't take grounding lightly, but don't let it panic you. Startled amateurs often overlook such obvious measures as pulling up the centerboard. Relatively few boats are seriously damaged by the impact.

A quick hull check for unseen damage can be made with a bilge pump. Rapid progress with the pump indicates no serious leak, and the pumping may refloat you. (Each cubic foot of seawater out of the hull

lightens it by 64 pounds.) If the boat's taking on water at a dangerous rate, make her fast by anchoring or tying to rocks.

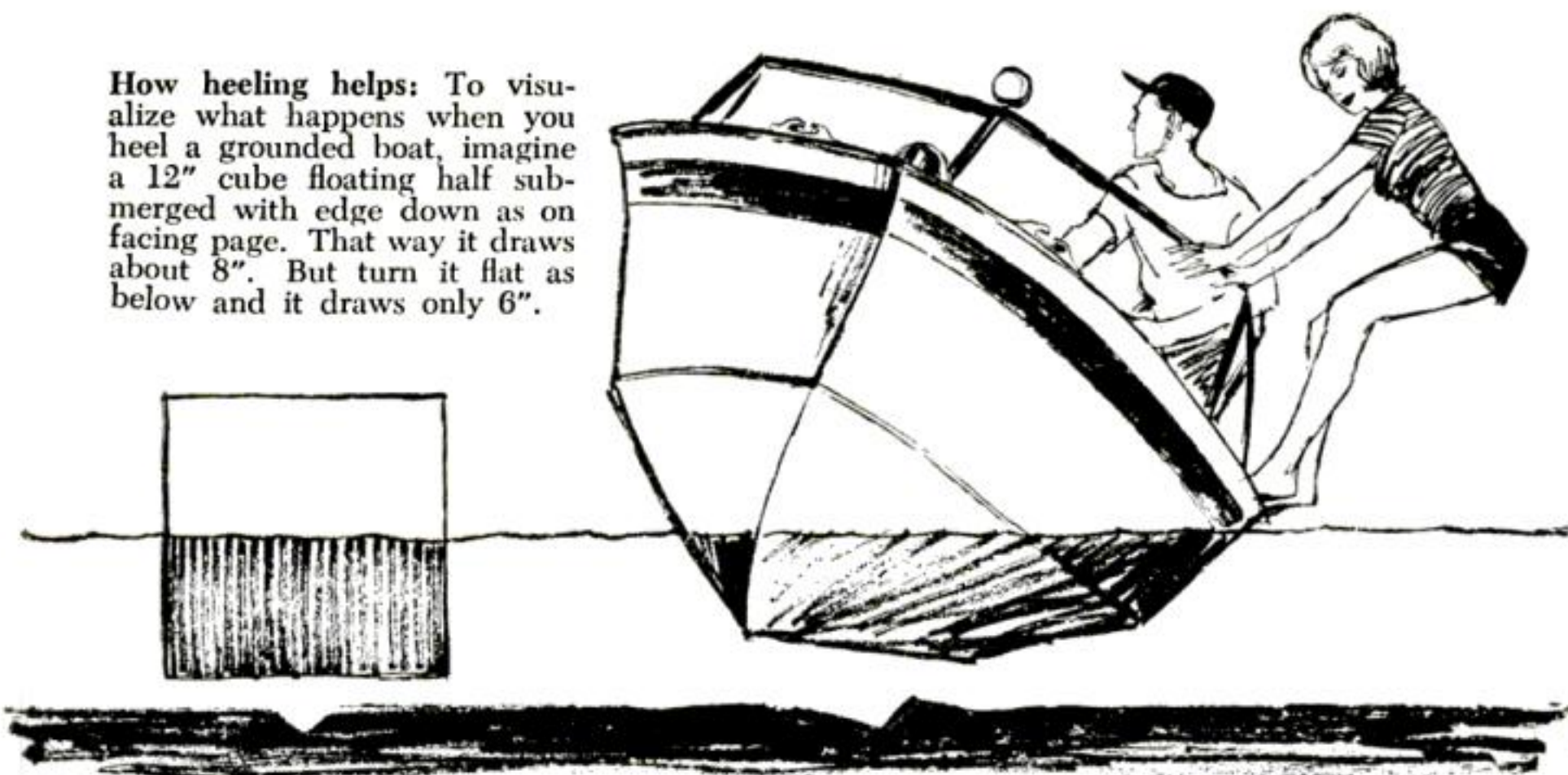
If the hull is undamaged (in tidal waters) the tide tells you how fast to work. Rising, the tide will refloat most pleasure boats within an hour unless it is about to turn. If in doubt, work fast. On a falling tide, if you can't get free in time, try to jockey your boat to settle and rise safely.

On sand, use an oar or boat hook to try to push off along the way that you came in—the best route, as your keel has already cut a channel. If she doesn't move, go overboard from the bow, stand on the shoal, and push. To trim boat weight and add push, take a passenger with you on the shoal—but leave someone aboard who can handle the boat when she's free. If you're alone, don't let the boat slip away; fasten a line with plenty of slack from the boat to you or to an anchor in the shoal.

Help from afar, if you're alert, frequently comes in the form of waves kicked up by a passing ship or powerboat even at

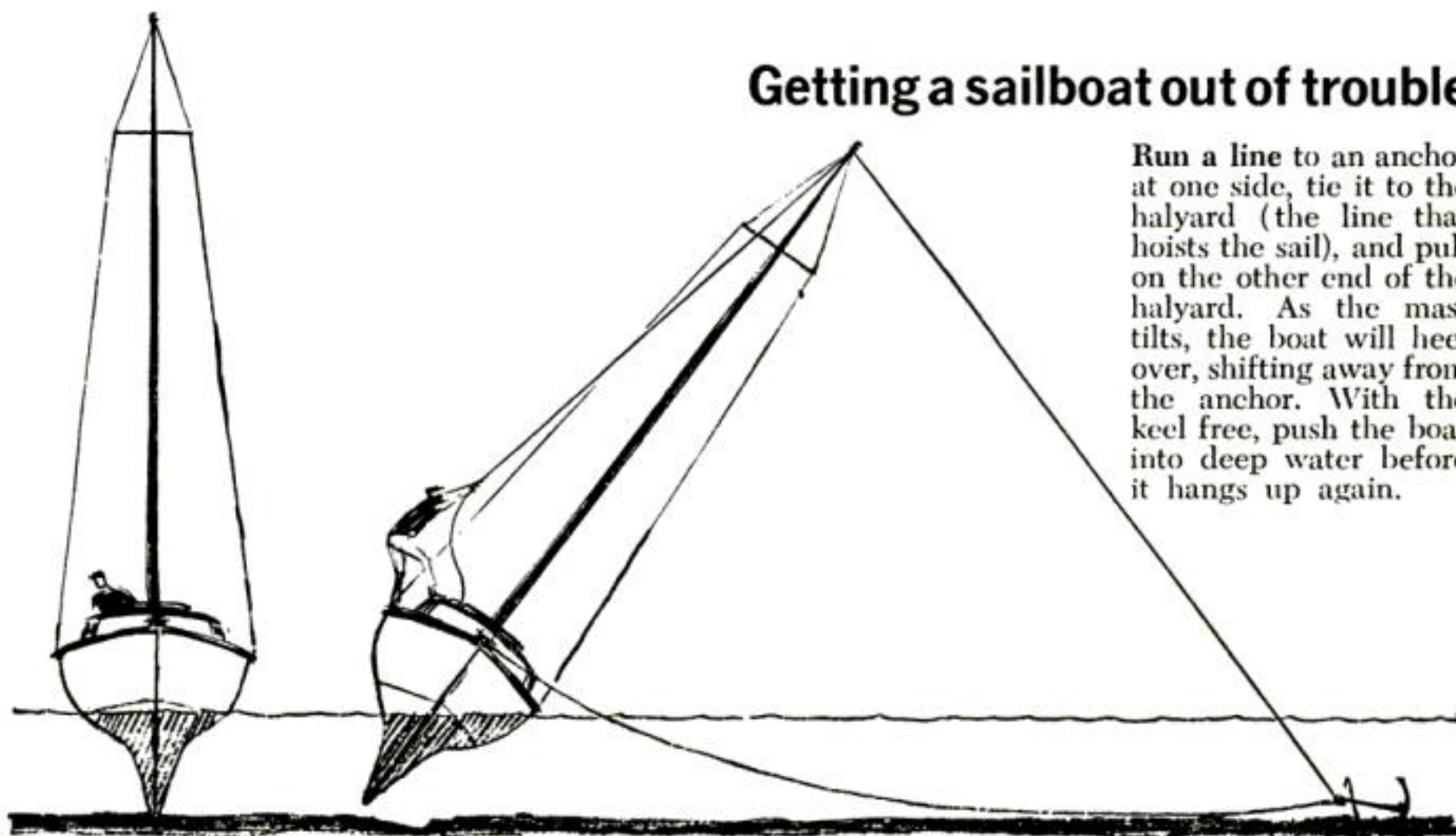


**How heeling helps:** To visualize what happens when you heel a grounded boat, imagine a 12" cube floating half submerged with edge down as on facing page. That way it draws about 8". But turn it flat as below and it draws only 6".

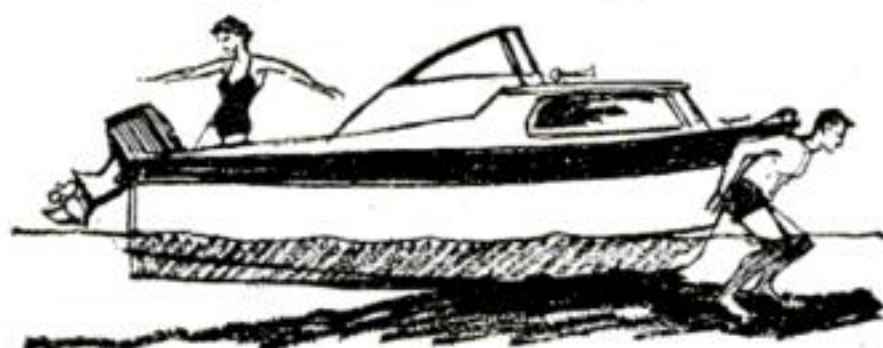


## Getting a sailboat out of trouble

Run a line to an anchor at one side, tie it to the halyard (the line that hoists the sail), and pull on the other end of the halyard. As the mast tilts, the boat will heel over, shifting away from the anchor. With the keel free, push the boat into deep water before it hangs up again.



## Two ways off a sandy shoal



Best way is to push with your back against the boat after shifting movable weight to deep-water end. Position legs to give lift. Have passenger rock boat as you shove. If bottom



conditions make going overboard to push risky, try poling the boat off. On small boats hung up amidships, endwise rocking on sand or mud can give extra help as you push.



## When a boat is grounded aft

If bottom is sand or mud, turn the boat around if possible so it heads back the way it came. Tip it up if it's an outboard. The length of the boat gives you good leverage for poling or pushing. On rocks, move boat carefully to prevent damage.



Shift weight forward after boat has been turned; the stern may float free, or at least it will be easier to free by poling or other means. Tie tiller centered, if you lack a helper, until you reach deep water and are ready to get under way again.

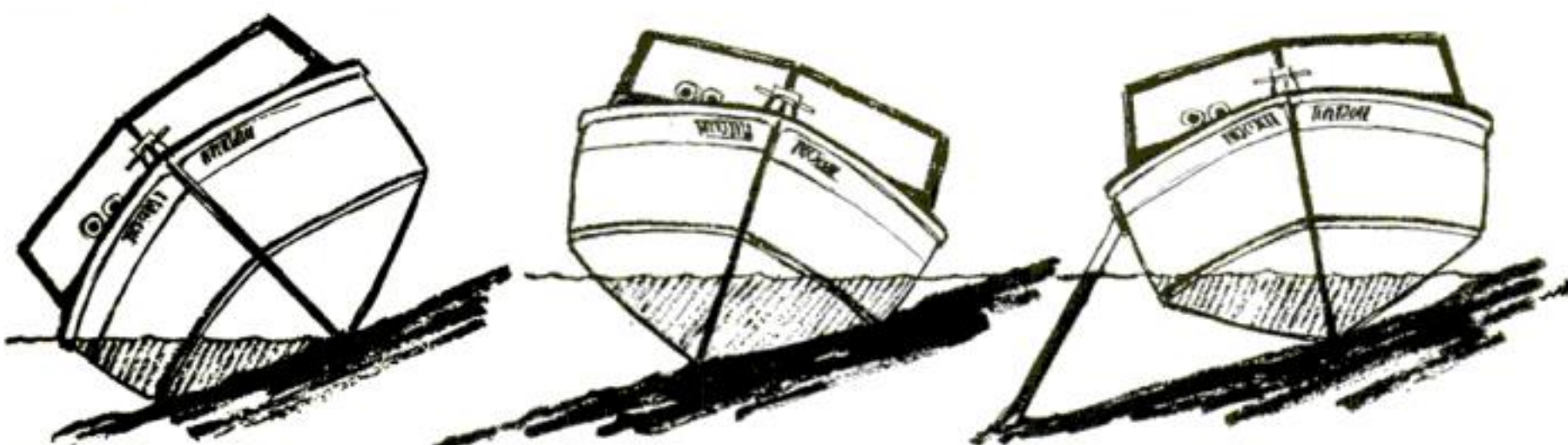
## When a boat is grounded on a mud bottom



When the boat won't come free by shifting weight to lighten the grounded section, reverse the weighting procedure. Shift all the movable weight forward to press the hull deeper into the mud, as in the center above. Even add a little bilge if the movable weight isn't enough

to press down the hull. Next shift all the weight aft and pump the bilge dry. Even though the hull doesn't rise above the original level of the mud, it'll probably come clear because the extra weight will have created a depression in the mud bottom.

## On a sloping beach or a shoal with the tide falling



The big thing to avoid is letting the boat tip toward low side of the slope, as at left, when tide goes out. If you do, boat will be swamped as tide comes in, for water will go into the hull before there's enough to float it. So tilt it in

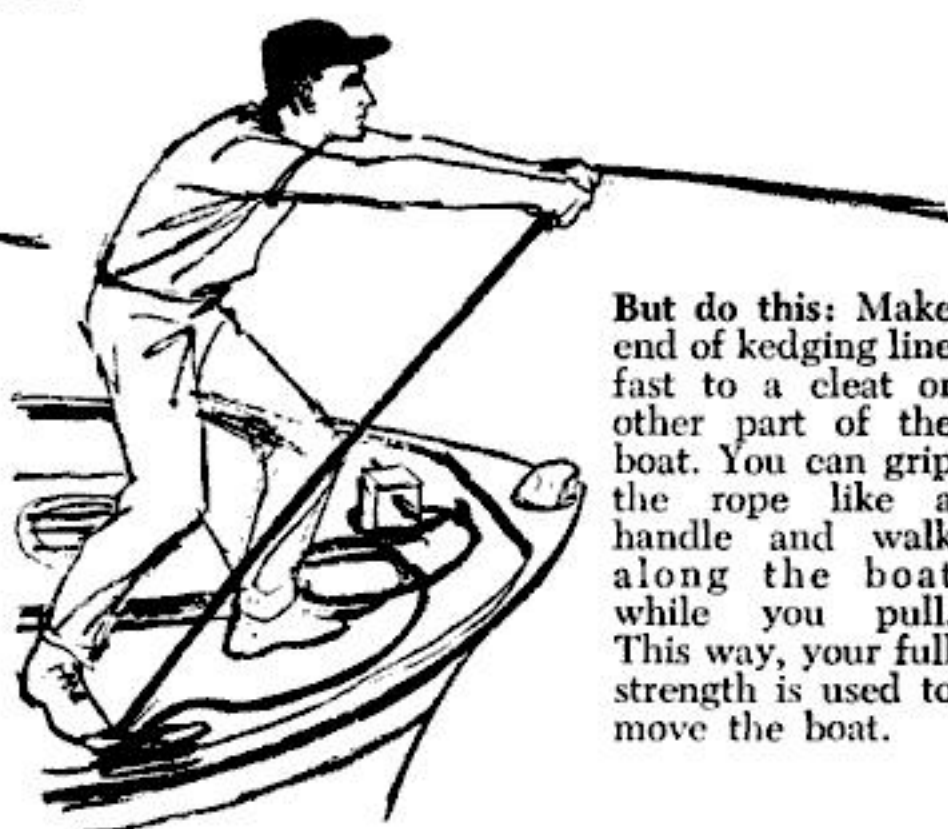
the opposite direction if you have a choice. On most boats this will lift gunwale before water can come aboard. If grounded boat already has begun to tilt, shore it up, as shown at right, while you still can.



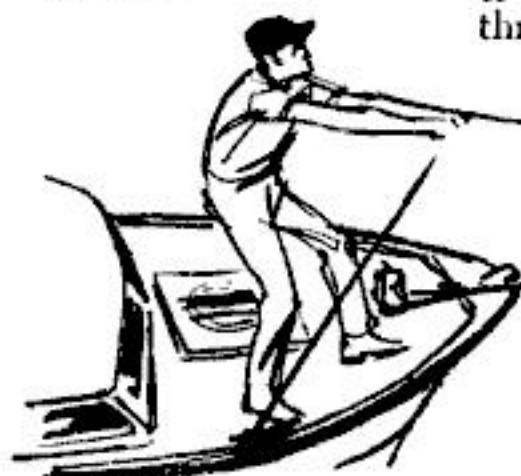
## How to make kedging-off easier



**Don't do this:** Pulling directly on the line when you're kedging is poor technique. Your pulling power is limited by the strength of your fingers and how tightly you can grip the rope to keep it from slipping through your hands.



**But do this:** Make end of kedging line fast to a cleat or other part of the boat. You can grip the rope like a handle and walk along the boat while you pull. This way, your full strength is used to move the boat.



**Best bet of all** is a tackle to increase your pulling power. Even if you have just a single pulley, you can use it as shown in the above sketch to double your pulling power. Tie the end of the anchor line to the pulley and loop the pulling rope through the pulley.

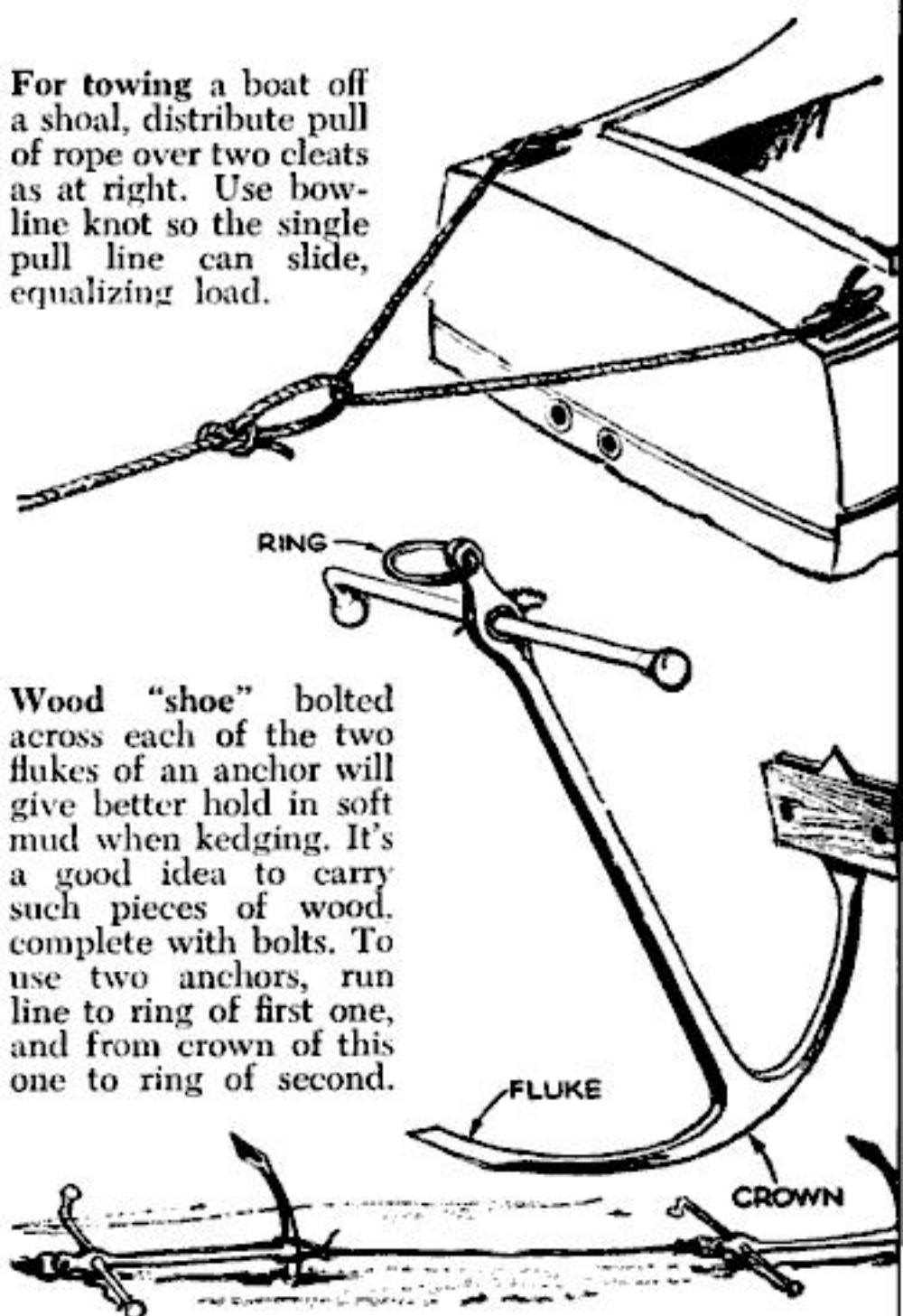
considerable distance. If you're ready to push hard when the wake arrives, it may provide the added lift you need. Forty-footers have been refloated by the swell from passing freighters beyond signaling distance.

**Heeling is another trick.** It works on most V-bottom and deep-keel boats when other methods fail, as both types draw less water when tipped. If she's headed in the right direction, a sailboat may also be heeled (though grounded) by trimming her sails in flat when the wind is strong enough. Heel a powerboat by shifting weight and passengers. In either case, have a husky shove under way as she heels, to send her toward deep water before she can hang up again.

On rocks, footing may be slippery when you go overboard. If the grounded section of the keel is accessible—it may be out of reach on a deep-keel boat—use an oar as a pry bar to inch the boat back toward deep water (but never pry against planking). On slippery rocks, prying is safer than shoving; and, unlike sand, rock provides a good levering fulcrum.

Some cautions here: Don't rock the boat on a rocky bottom; it can't help and may

For towing a boat off a shoal, distribute pull of rope over two cleats as at right. Use bowline knot so the single pull line can slide, equalizing load.



Wood "shoe" bolted across each of the two flukes of an anchor will give better hold in soft mud when kedging. It's a good idea to carry such pieces of wood, complete with bolts. To use two anchors, run line to ring of first one, and from crown of this one to ring of second.



cause damage. Before heeling, probe to make sure planking will clear any rocky projections. A boat heeled by a line from the masthead tends to "crab out" and move *away* from the heeling anchor. Probe for obstructions in that direction, too.

**Kedging-off.** This is often the best bet when hull depth and deep water won't permit you to push effectively from the shoal. It requires a dinghy so you can row an anchor back toward deep water and drop it as far from the grounded boat as line permits. If you have two anchors, use the best one closest; set the other farther out to back it up. Then pull the boat toward the anchor, preferably with a tackle if you can rig one with gear aboard. In an emergency, such as threatening weather, jettison unnecessary weight and let passengers who can swim go overboard temporarily in life jackets.

In mud, rocking the boat will churn a slight hollow under her, and often frees her completely where she stands. The rest of your bag of tricks may be limited to kedging or towing. A pole simply sinks in the bottom, and if you go overboard to push you may just push yourself in deeper.

Use the propeller in any grounding if it's undamaged, clear of the bottom, clear of any obstruction immediately astern, and if the cooling inlet is in clear water. Propeller thrust is lessened in reverse, but can still be effective if you use it in bursts of speed timed with a poling push, a shove from the shoal, or a pull on a kedging line. (But watch that line so it doesn't foul the prop.) Using the rudder or outboard to swing the stern slightly from side to side often gets results faster than a straight reverse pull.

If another boat assists, be sure the towline is *eased* taut before full power is applied. Many a boat, grounded intact, has had her transom pulled out by a towline snapped taut with a bang. For protective "give," even a short section of nylon line tied into other types will help.

If you're stranded offshore with a badly damaged boat anchored to a rock or shoal, make a line fast to the boat with plenty of slack and a large bowline in the free end. Slip this loosely under your arms if the tide is likely to rise above the boat. Then you can float in a life jacket without danger of drifting farther out, and you can free yourself quickly if the boat slides into deeper water. ■ ■

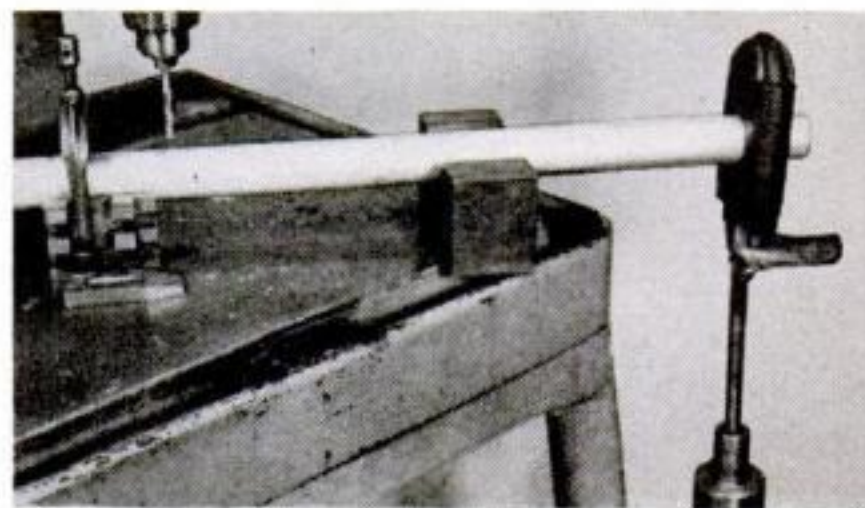
## ...how to make

Here's a handy adjustable arbor I learned about from an old machinist under whom I served my apprenticeship. It will handle a wide range of work and is especially useful for narrow work that is ordinarily troublesome to hold.

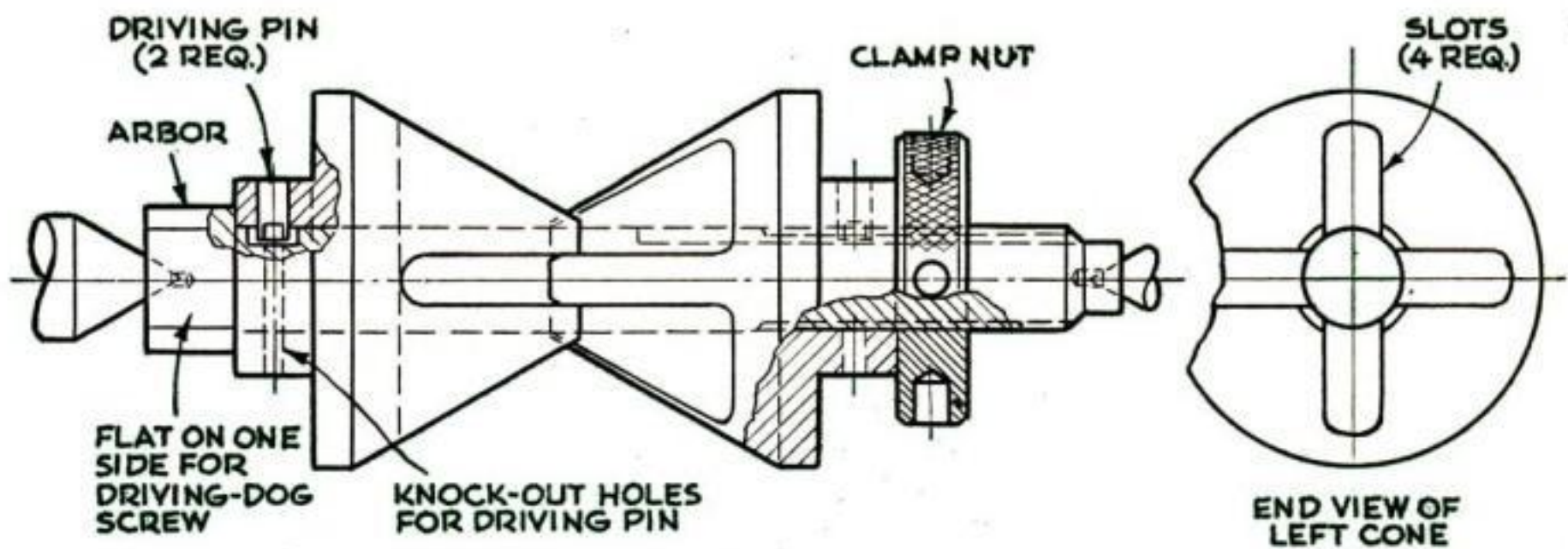
### ... pendulum helps align holes

Here's a neat trick I often use when I need to drill a row of holes in a straight line in round stock. Two V blocks support the work on the drill-press table. Clamp the block nearest the drill so that it holds the work centered under the drill. The other block is only for outboard support and may be left loose.

Clamp a weighted pendulum to the outer end of the work. It will maintain alignment of all holes drilled in a straight line as the work is unclamped and moved lengthwise to various positions for drilling. The pendulum shown in the photo below was improvised by tack-welding a rod and a heavy piece of scrap to an old lathe dog.—H. J. Gerber, Menomonie, Wis.



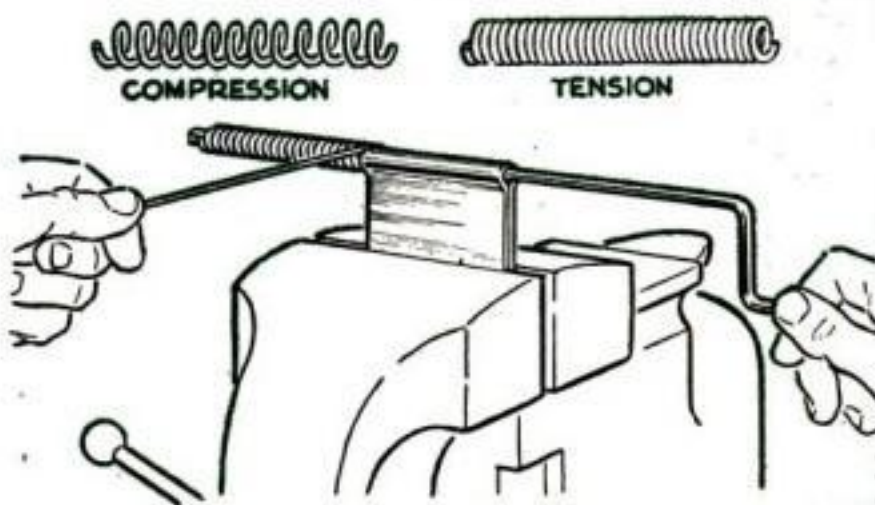




## an adjustable arbor

Make the two conical members with a 60-degree included angle. They should be a slip fit on the arbor. Choose dimensions to suit the range of work you'll handle. Mill slots at right angles in the cone on the left, as shown. Cut away the other cone to leave

four mating tongues that will fit loosely in the slots cut in the first cone. Thread the right end of the arbor and make up a knurled clamp nut to fit. Cut keyways in the arbor to receive driving pins. File flats on one end of the driving pins to fit the keyways. In the hub of each cone drill holes that will be a drive fit for the pins.—*M. W. Loftus, Chicago.*



### ... an easy way to make springs

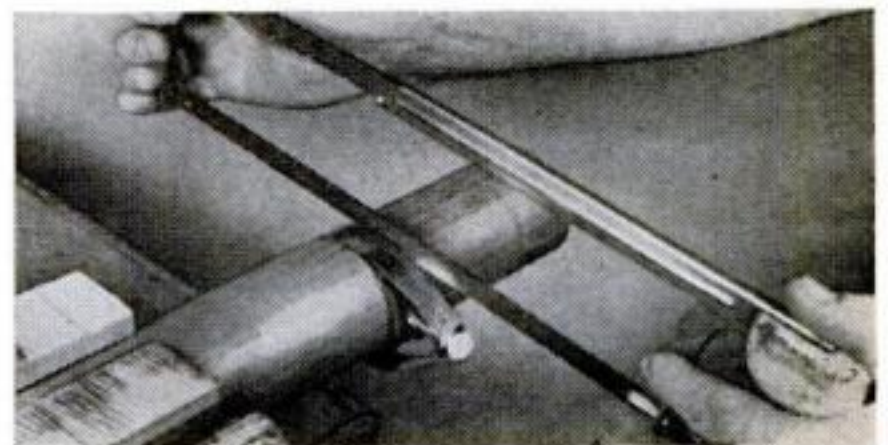
While working in many shops in the last 20 years, I've seen a lot of time wasted looking for small special springs or setting up a machine to wind them. Here's a ridiculously simple gadget I use that will

wind you a spring in a jiffy—without a machine—using a rod as a mandrel. Simply bend a crank on the end of a rod that is slightly smaller in diameter than the desired inside diameter of the spring. Saw or file a slot in the end of the rod opposite the crank. Fold a scrap of sheet metal around the rod as shown, and clamp in a vise.

Start the spring with the slotted end of the mandrel at the edge of the sheet-metal bearing. Insert spring wire in the slot and start cranking. You'll be surprised at how accurately you can control the pitch, to make either a tension or compression spring, by simply varying the rate at which you push the mandrel through the bearing as you turn the crank.—*Harvey McClellan, Willow Grove, Pa.*

### ... a clamp is a good hacksaw guide

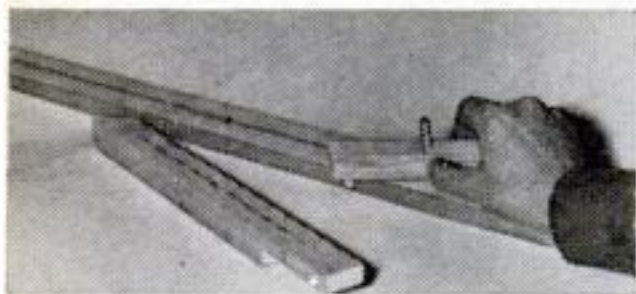
An adjustable hose clamp, tightened around a piece of metal tubing or shafting, will serve as an accurate guide for making a square cut-off. Aircraft-type hose clamps, often found in surplus stores, are accurately made and ideal for this purpose.—*H. J. Gerber, Menomonie, Wis.*





## Short Cuts and Tips

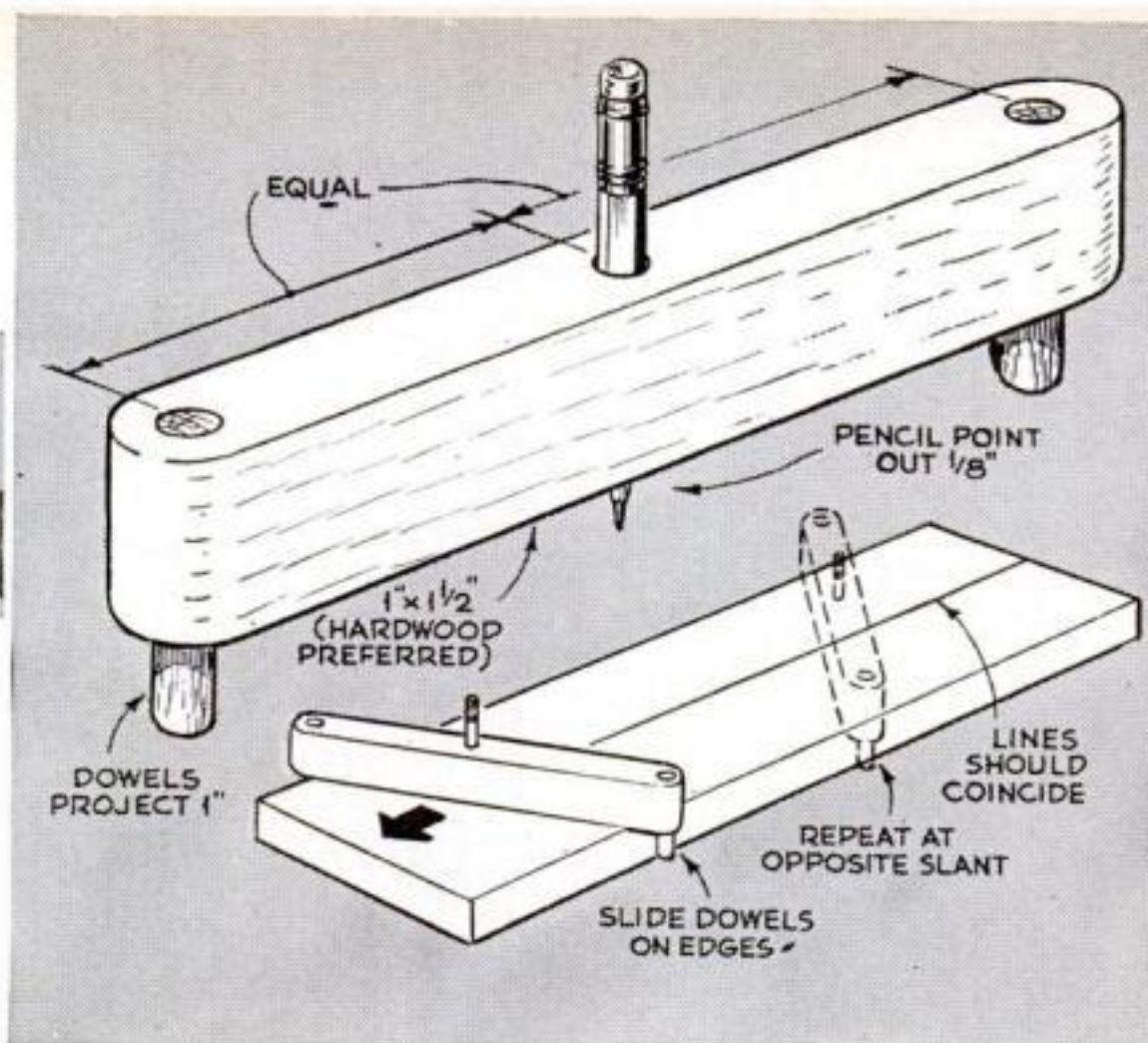
FROM PS READERS



### Gauge scribes centerline on long boards

You can skip tedious measuring to find the centerlines on long boards. This simple gauge can be used wherever the edges of the stock are parallel.

Choose a block 2" longer than the greatest board width you're likely to mark, and spot three equally spaced holes as shown. Drill the middle one for a push fit for a hard pencil (or drive in a sharpened wood



screw as a scratch point). Slant the gauge across the stock, twisting to clamp the dowels against the edges as you draw it along. Repeat with the gauge slanted the other way.—Harry Walton, White Plains, N.Y.

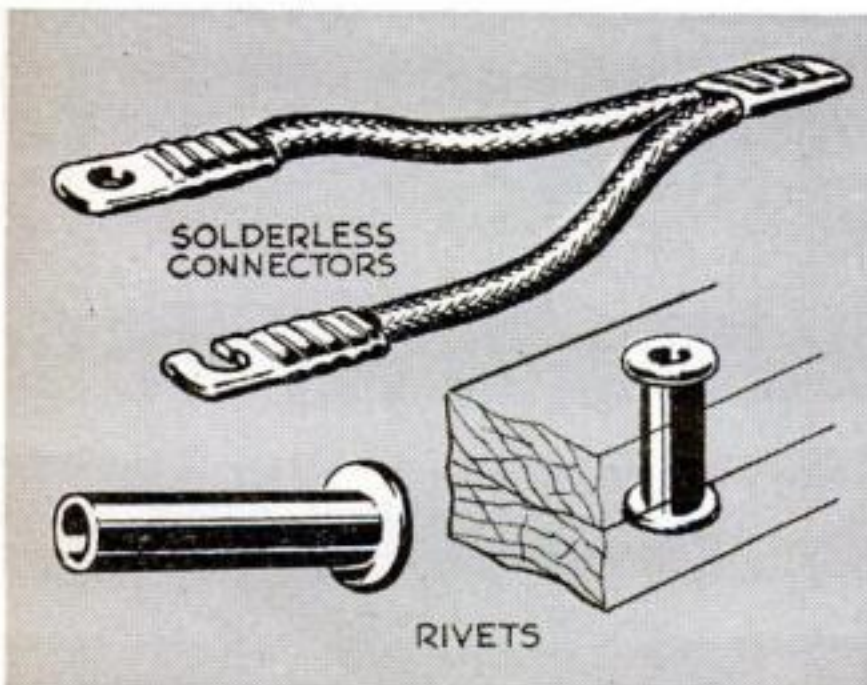
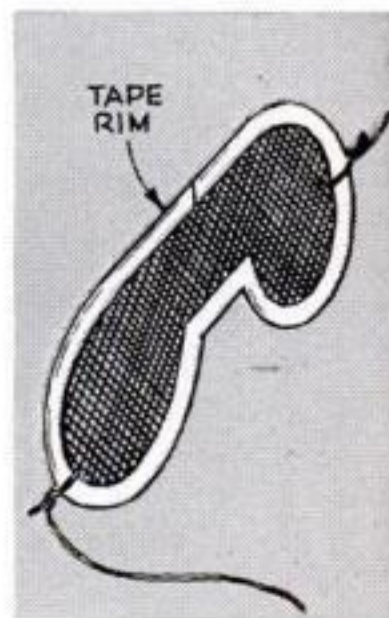
### Small tools from hardened nails



Nails intended to be driven into concrete are specially hardened. By squaring off or reshaping the points on a grinder, you can convert these sturdy nails into such custom-made tools as prick punches, drift pins, and nail sets.—R. J. De Cristoforo, Los Altos Hills, Calif.

### Eye-guard from window screening

Before tackling a project that involved chipping stone with a star drill, I protected my eyes with a guard snapped from scrap aluminum screening. I used a paper pattern for the screen, bound the edges with tape, and stapled on tie strings.—J. H. Matthews, St. Louis, Mo.



### Uses for scrap copper tubing

Leftover pieces of copper tubing are never wasted in my shop. I make solderless connectors by trimming pieces to required lengths and clenching them onto stripped wires with pliers or a cold chisel. Then I drill a hole or file a slot. Tubing scraps also make good rivets. I flare one end, pass the tubing through a snug hole in the work, and use a round-end punch to flare the other end. To tighten the rivet, I place the pre-flared end on an anvil and strike the other with a ball-peen hammer.—Cecil F. Cooper, Morehead, Ky.





Now you can use the purring power of electricity anywhere

# New Battery Tools for Outdoor Chores

By Sheldon M. Gallagher

**Y**OU'LL see a new breed of yard tools this summer that may cause you to rub your eyes and look twice. You'll see a quiet-purring power mower that runs on electricity, yet trails no electric cord.

You'll see power-operated hedge trimmers, grass clippers, and lawn edgers that can be used as far away from the house as you like—all without tying you to the end of a 115-volt extension cord. Their power will come, instead, from rechargeable batteries carried right along with them.

CONTINUED

149





**You can run a lawn edger or hedge trimmer** with the wheeled battery cart shown here and on the preceding page. Made by Little Wonder, Inc., Southampton, Pa., the edger also doubles as a grass trimmer, sells for about \$60. The battery cart, with charger, costs about \$63.



**Silent power for this 19" rotary mower** comes from an ordinary car battery hidden under the hood. The mower has a built-in charger and removable switch key to prevent accidental starting by youngsters. Price: about \$125 from Lambert, Inc., 519 Hunter Ave., Dayton, Ohio.

These bright new go-anywhere tools are the latest advance in the booming development of battery power, begun less than a year ago with Black & Decker's cordless electric drill. Today, half a dozen major makers either have or expect to have a new

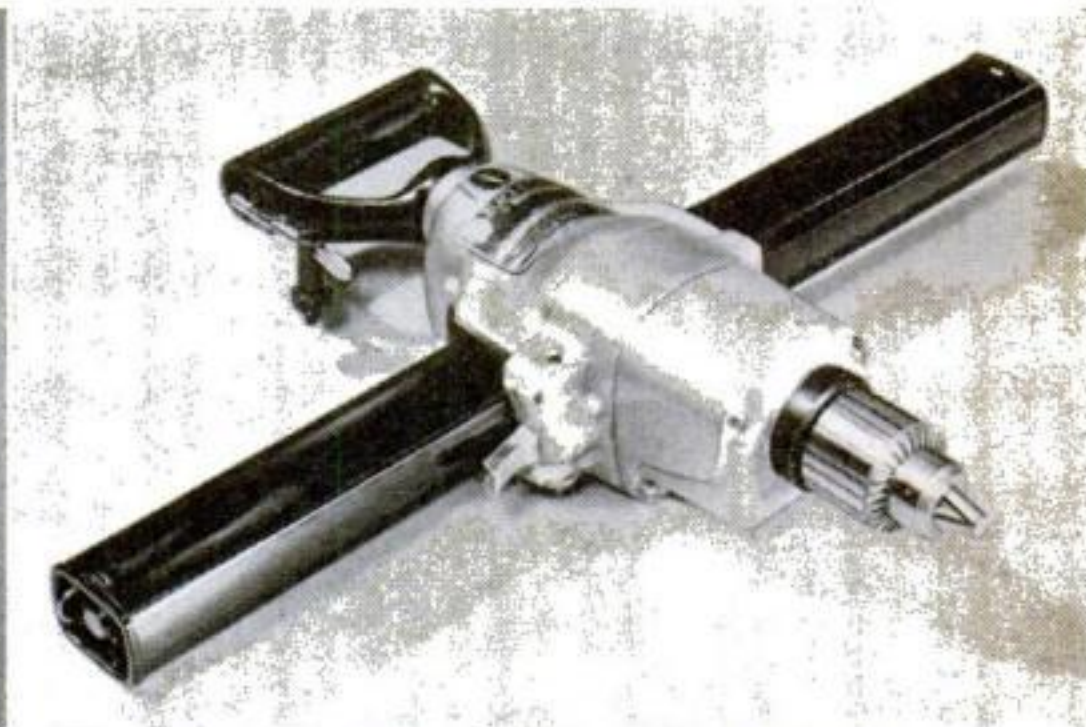
crop of cordless tools ready for summer chores.

The result may well start a small revolution in outdoor home maintenance, where cordless power makes real sense. One reason for the slow growth of early electric mowers

## Also coming: a new batch of rugged, battery-driven drills



**Weighing only 3½ pounds**, this new ⅜" drill from Skil can be powered by a separate battery pack or a standard car battery for work around cars and boats. It will sell for about \$50.



**Two-speed ⅜" drill**, coming from Black & Decker this fall, will give you a choice of 300 or 600 r.p.m. It runs on two rechargeable cells that slip into the hollow side handles.





A separate battery pack powers this Skil hedge trimmer. The tool can trim 200 feet of average-size hedge on a single charge. Prices are about \$60 for the trimmer, \$50 for the battery pack, and \$15 for the charger, from Skil Corp., 5033 Elston Ave., Chicago.

was their unfortunate habit of snarling a hundred feet of power cord around trees and shrubs and occasionally mowing right through the wire itself. With battery power, this is no problem. Also eliminated is the

[\[Continued on page 206\]](#)



Two-way shrub and grass shear, another new-comer from Skil, can be powered from same battery pack that runs hedge trimmer (left). Wheeled handle lets you work standing up and holds the blade vertical for edging or flat for trimming. Price, with handle: about \$65.



Completely cordless, Black & Decker's hedge trimmer runs on a self-contained battery hidden in the handle. Its two-edged blade cuts in either direction to simplify maneuvering.

New dual charger, made for B & D's trimmer above, can charge two batteries at a time for longer use. Trimmer, charger, and battery sell for \$99.50 from Black & Decker, Towson, Md.



This battery-pack drill will come in  $\frac{1}{4}$ ",  $\frac{3}{8}$ ", and  $\frac{1}{2}$ " capacities and in a choice of speeds. The Porter-Cable tool is made by Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh.





# what's new in PHOTOGRAPHY

Interchangeable accessory lenses slip over the rim of the reflector to make your flash gun do four special jobs: A deep-grooved bounce lens directs two-thirds of the light toward the ceiling; multiple prisms of a wide-angle lens spread light coverage a full 70 degrees, assuring edge-to-edge illumination; a gray close-up lens cuts light intensity four full stops; and a salmon-colored lens converts normal daylight balance to that of clear flashbulbs for better pictures with Kodacolor or Type-F reversal film. They fit Futuramic II unit. Kit, with adapter ring and zipper case, \$8.95. Minneapolis-Honeywell Heiland Div., 5200 E. Evans Ave., Denver.

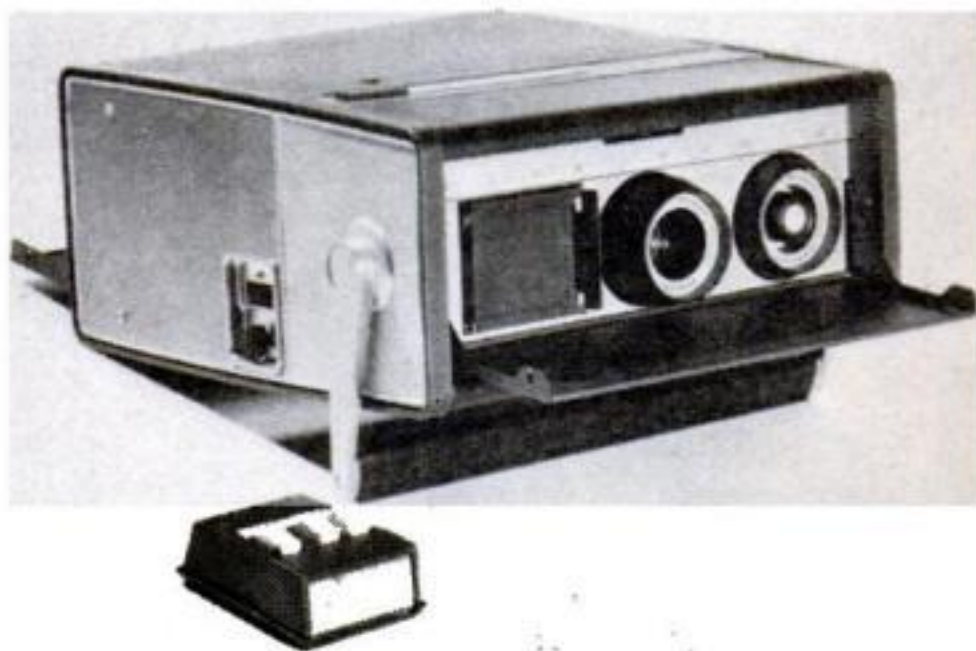


▶▶▶Round-the-lens meter of electric-eye camera not only sets aperture to coordinate with preset shutter speed—a needle and f-stop scale inside the viewfinder register a setting so you can change depth of field

manually if you wish. On automatic setting, you can't trip the shutter unless there's enough light for good exposure. Canonet sells for about \$113. Bell & Howell, 7100 McCormick Rd., Chicago.



Built-in pushbutton pan head assures slow, even panning with 8-mm. movie camera. Telescoping tripod folds to make hand grip. Motorized gear in base sweeps lens left or right 120 degrees, and electric eye adjusts for proper exposure as you swing from sun to shade. Power zoom is by pushbutton. DeJur Power Pan models list at \$139.95 to \$209.95. DeJur-Amsco Co., 45-01 Northern Blvd., Long Island City, N.Y.



Slide-projector remote control hits the medium-price range with 947 Tele-Sonic Wireless. Small control unit focuses and changes slides in forward or reverse sequence up to 40 feet away by high-frequency sound waves, or you can do it manually. Projector is own carrying case. Flip lid protects lens and controls in transit or storage. Price is about \$150. Bell & Howell, 7100 McCormick Rd., Chicago.



**Professional-type flash gun** (right) is a portable unit that will give an advanced amateur the same lighting quality as bulky 5,000-watt equipment, without special wiring. It uses a 1,000-watt, high-silica halogen lamp with dimmer switch to reduce voltage for lower illumination or while focusing. Sun Gun Professional comes complete with flood lens, portrait lens, and standard four-leaf barn door for \$79. Optional accessories include filters, "snoots," super-spread lens, and large barn door (shown attached). Sylvania, NYC.

▶▶▶ Add a new flashbulb to the list: Sylvania's M-3, same size as the M-5 and M-25. It acts like both, and quick peak and long duration of flash make it as useful as an FP-26 with focal-plane or leaf shutter. Shredded zirconium filling gives 16,000-lumen-seconds light output. Available as M-3B for color.

Other news: GE is using rare-element rhenium in filaments to draw power effectively from weak batteries.

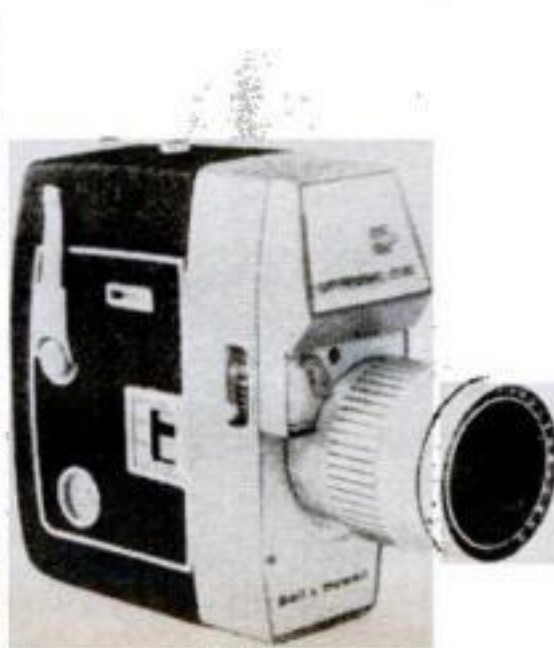
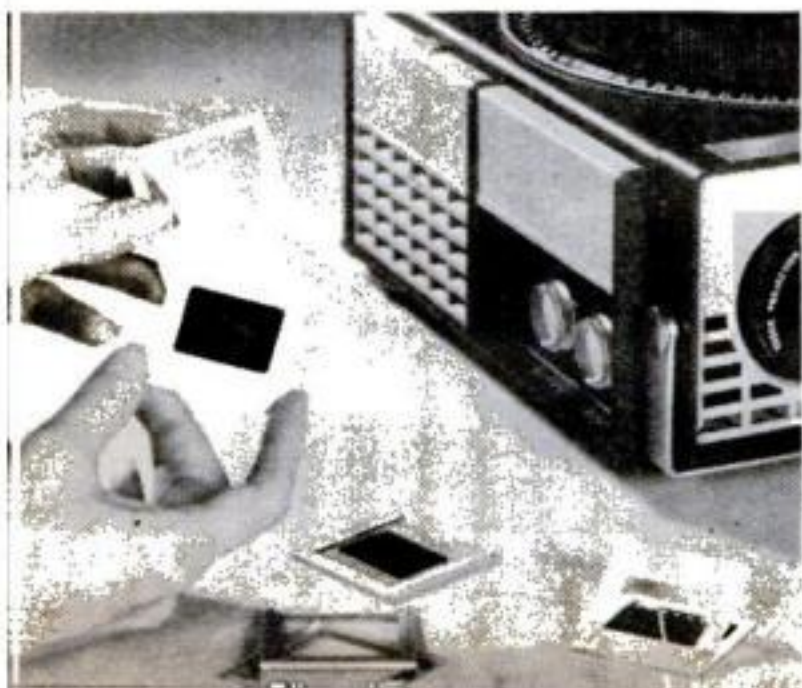
**Metal binder**, a three-sided zinc-coated steel frame, mounts color slides in glass without fuss of taping. It holds transparency, mask, and two pieces of thin cover glass, and fits most projectors. No fastener is needed. Box of 50 2-by-2s is \$1.95. Eastman Kodak Co., Rochester, N.Y.



**Behind-lens photocell** automatically adjusts to light on subject. Sensing system, powered by mercury battery, works smoothly at either normal or slow motion. Roll-film model, \$250; magazine, \$270. Bell & Howell, 7100 McCormick Rd., Chicago.

**Slide scribe** reduces handwriting by pantograph action as you mark slides with titles or commentary. It first die-cuts a slot at bottom of a 35-mm. mount and snaps in a plastic window on which the writing will appear. Price, \$55. Viewlex, Inc., Holbrook, N. Y.

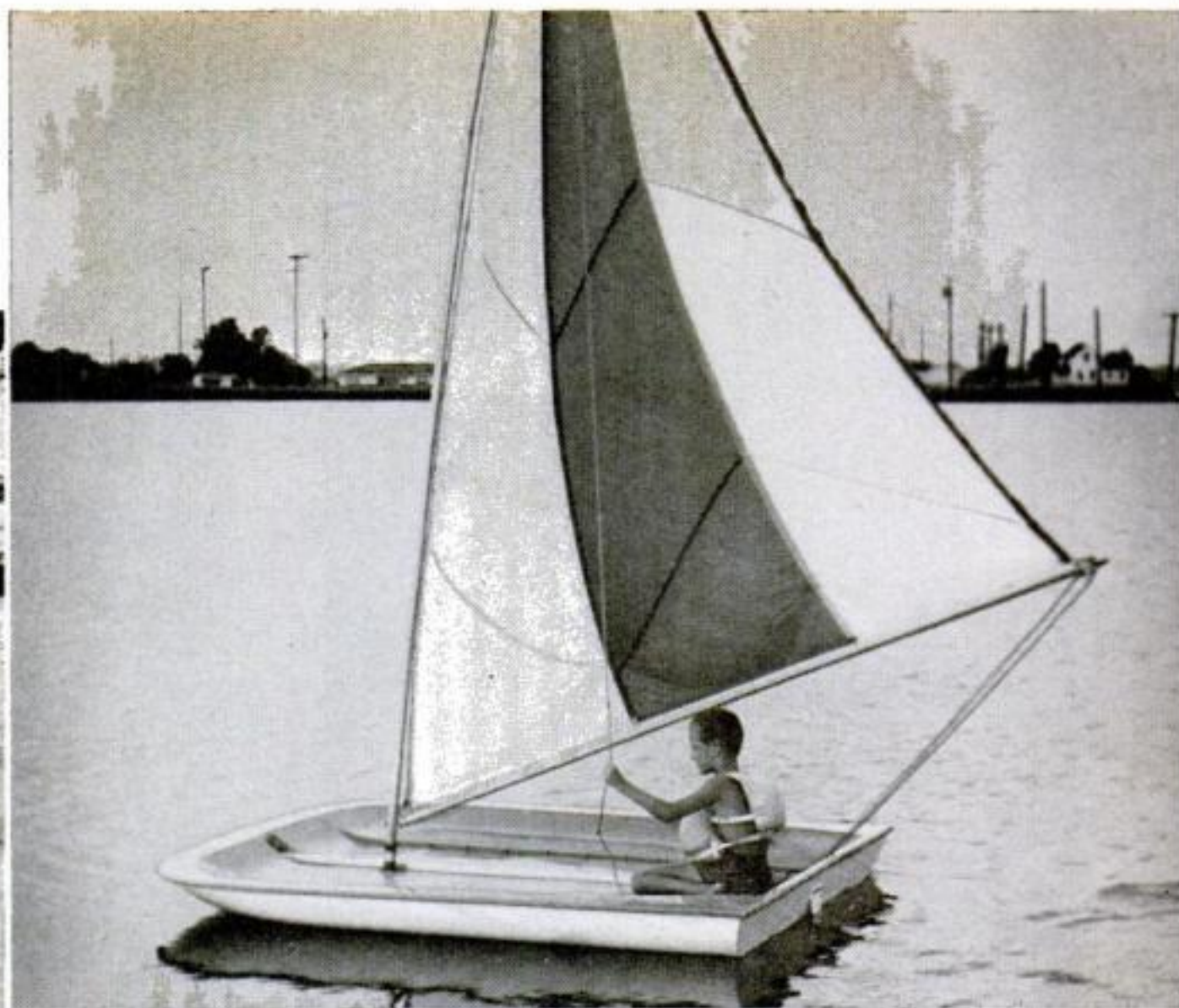
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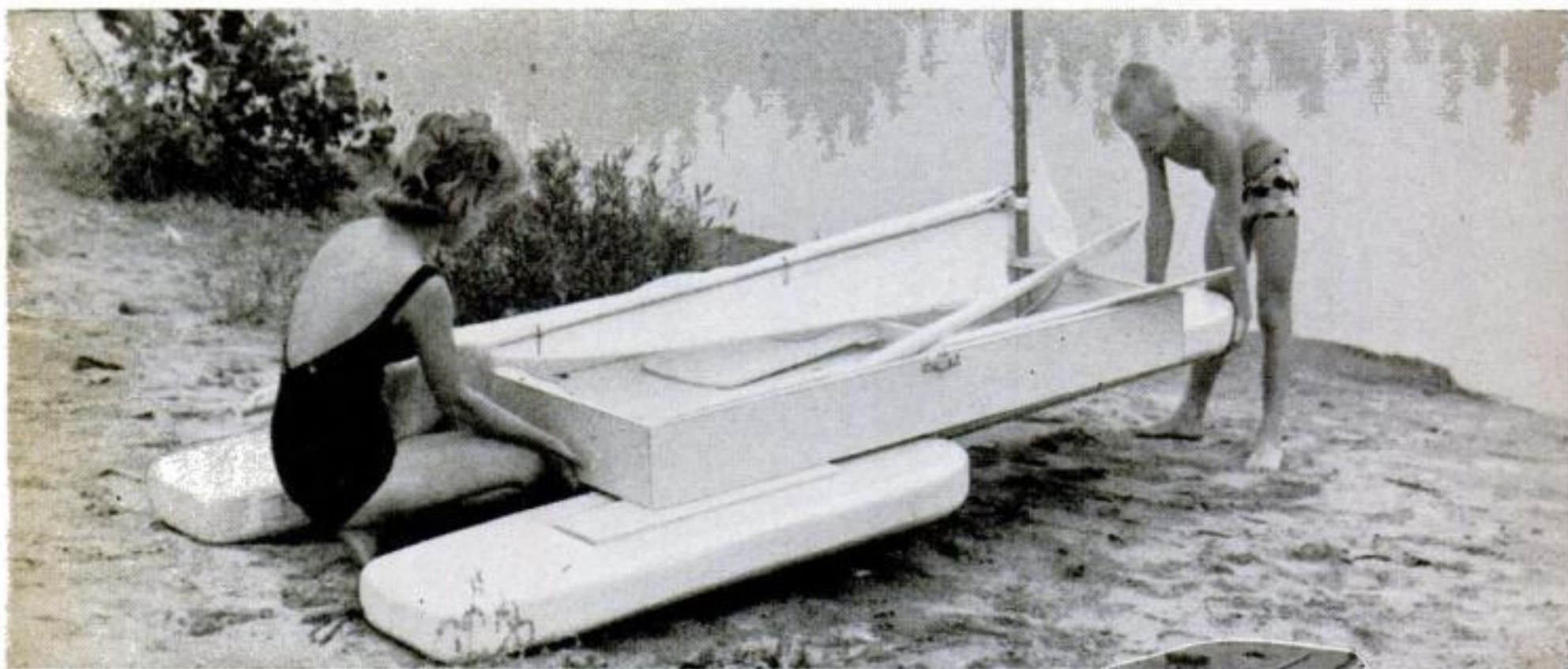
**what's new**

## in BOATING

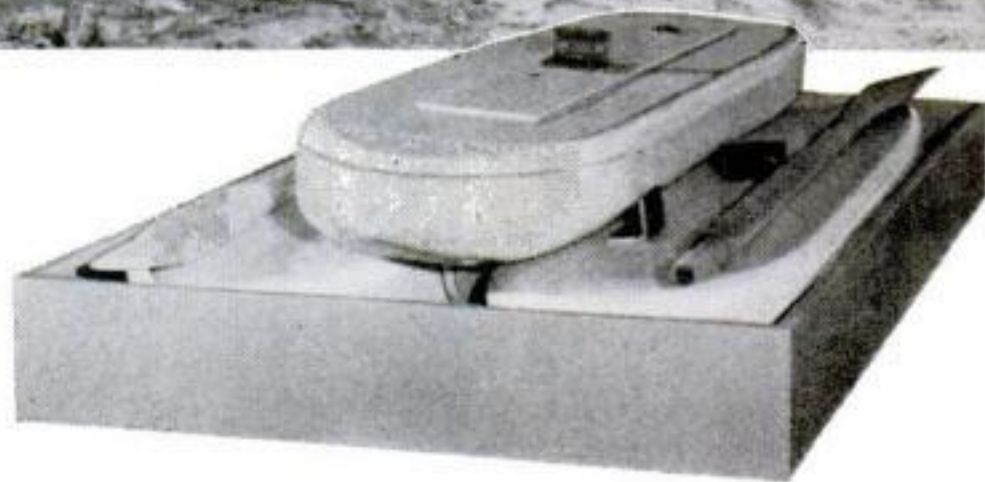


**Shallow-draft scooter** is a fiber-glass-and-foam shell. It can be carried on a car top held by suction cups and straps, or mounted as a hardtop on a runabout, slid off at the fishing grounds and flipped into shallow

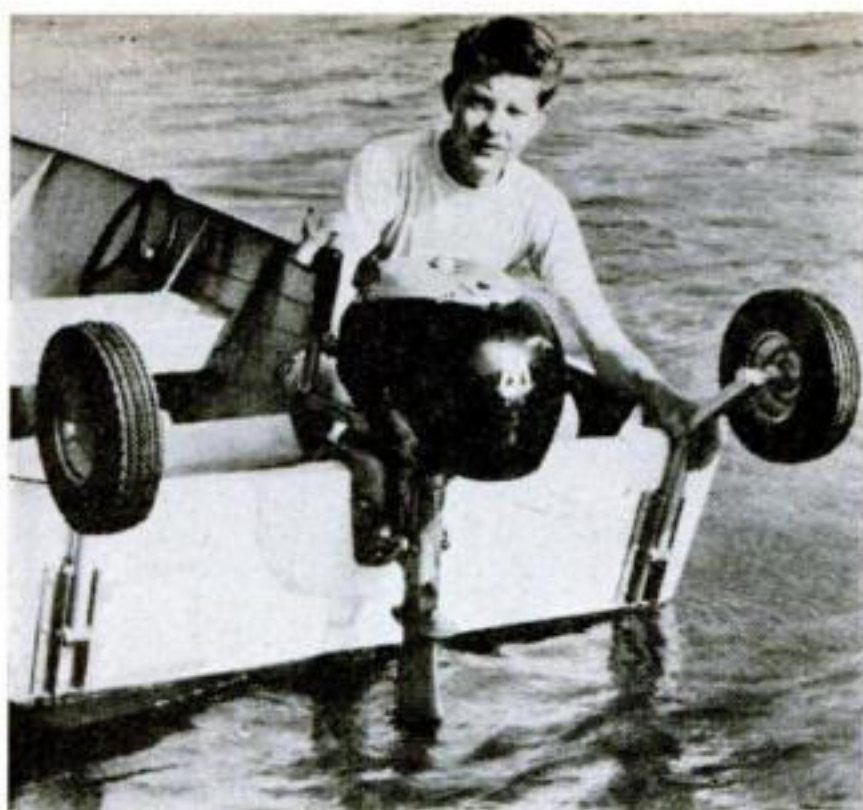
water. Available as a mount for outboards up to 40 hp., or you can convert boat for sailing. Scoot-R-Top is \$259. Mounting brackets and seat extra. Ski-Mate Corp., Box 627, El Campo, Tex.



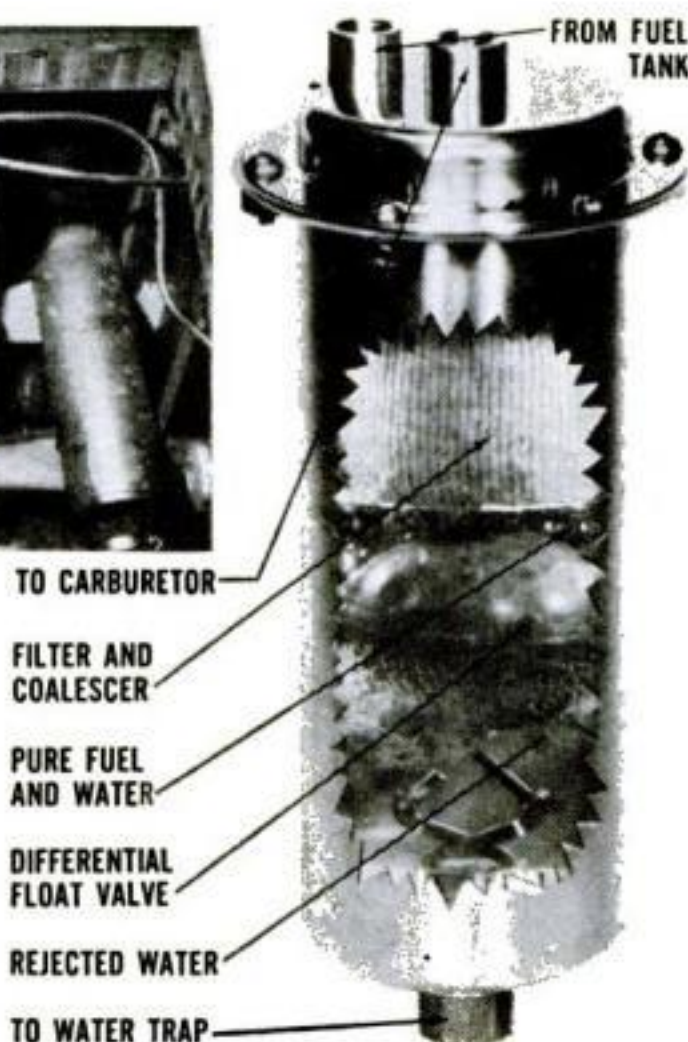
**Do-it-yourself boat** comes in seven models for sailing, rowing, or outboarding, and a special—for duck hunters. Lengths are 8' 6" to 9' 11", beam 50". Plywood Water Bug has three outrigger pontoons of unsinkable polystyrene. Kits, \$69.50 to \$174.50; finished boats, \$79.50 to \$194.50. Foam Plastics, Inc., Cambridge Springs, Pa.







**Retractable dolly** lets you wheel 14' boat without help, even over rough ground, and launch it without wading. Two leg and wheel assemblies pivot out of the way when the boat is afloat, carried on car top, or stored. If detached and accidentally dropped in the water, they'll float. Boat dolly sells for \$63.50. Jarco Mfg. Co., 11629 Vanowen, North Hollywood, Calif.



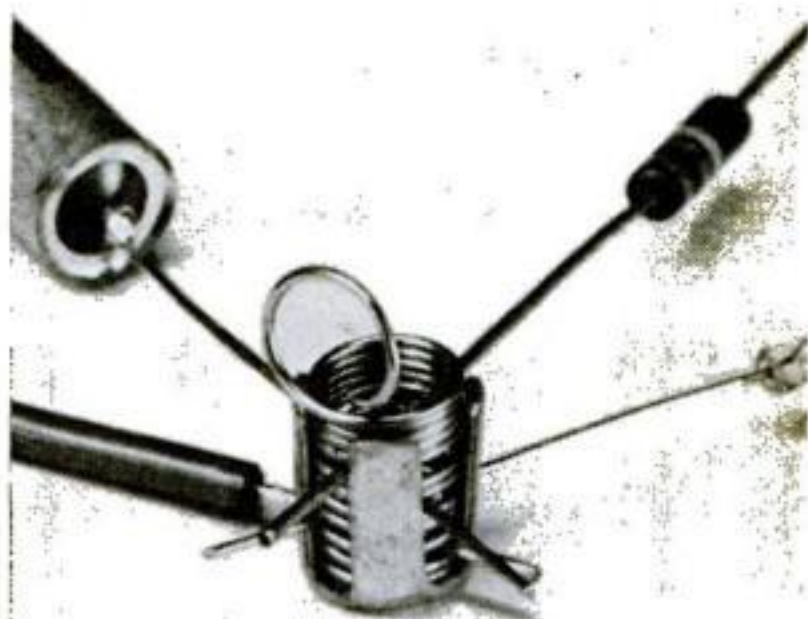
**Fuel and water separator** inserted in fuel line filters foreign matter from gasoline or diesel fuel and makes big water globules out of little ones so they'll sink. The water is ejected through a float valve and only water-free fuel passes on to the engine. SePall separator for outboards, \$19.95; inboards, \$39.95. Pall Corp, Glen Cove, N.Y.

**what's new**

## in ELECTRONICS



**TV kit** can be assembled without special technical knowledge. Included are a 19" aluminized picture tube, receiving tubes, wires, solder, and an 8½"-deep cabinet (steel with baked-on finish) to fit it all into. Price, \$135; or four pay-as-you-build packages, \$36 each. Conar Instruments, 3939 Wisconsin Ave., Washington, D.C.



**Solderless connector** is tension spring in forked cup that holds eight leads. With mounting screws for "breadboard" or panel, \$1.20 per dozen. Cosmic Voice, Inc., Box 11, Jackson, Mich.

CONTINUED

155



## What else is new in ELECTRONICS

**TV-camera tube** is slow-scan vidicon that produces one picture every eight seconds, converts it to audio signal on one track of stereo tape for storage by tape recorder or transmission by phone or radio. Electronic monitor at receiving end reconverts signal to image. Sound goes on alternate track. Westinghouse developed system for low-budget application to educational, commercial, and scientific television.

▶▶▶ **Midget intercom** lets you talk or hear 20 feet away from it. Two small transistorized transceivers connected by 65-foot wire operate on a nine-volt radio battery. Each has a built-in buzzer. \$19.50. P. A. Brown, 54 Ruxton Rd., Great Neck, N.Y.



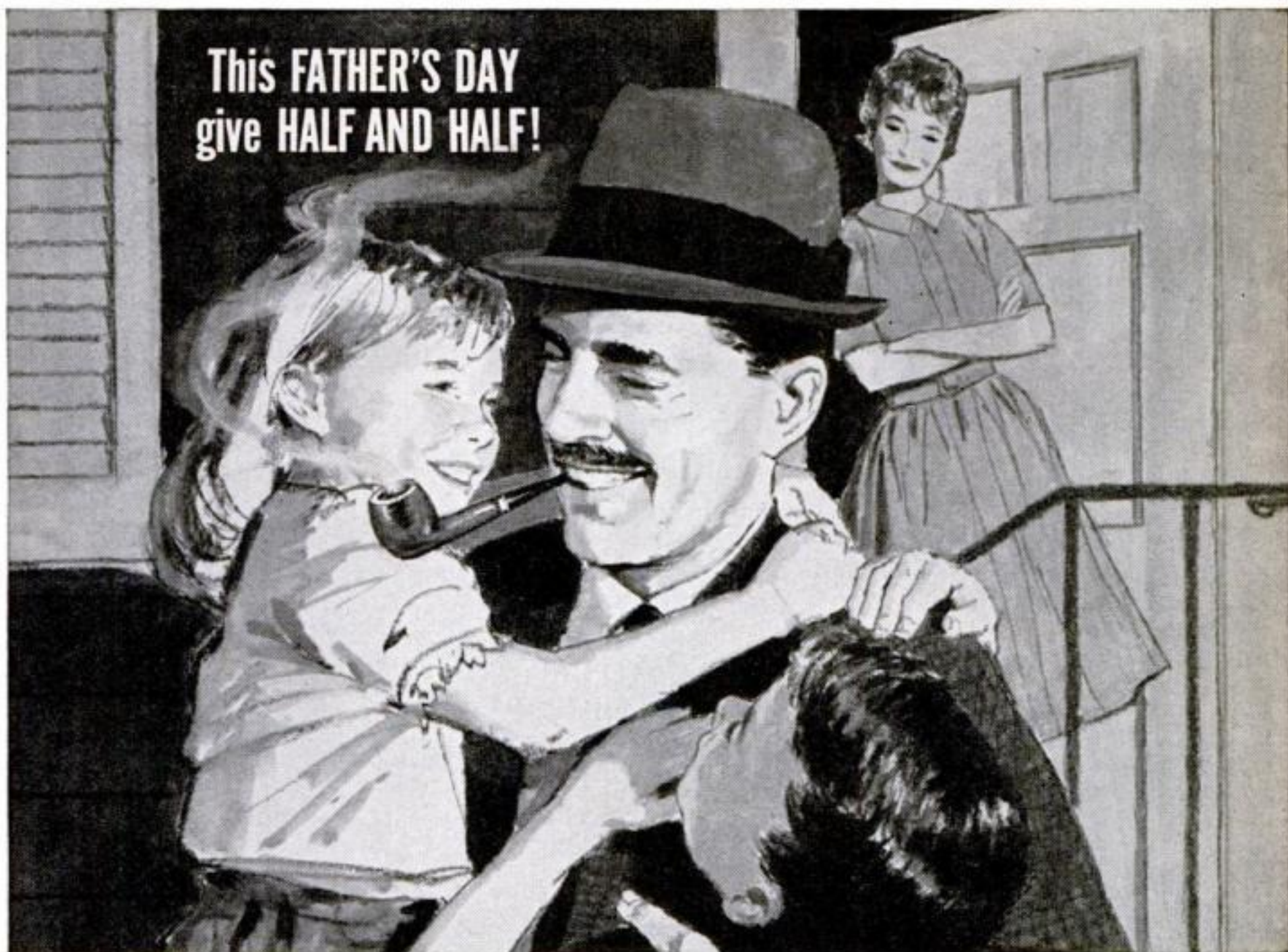
**Hi-fi speaker kit** packs a 1½-lb. ceramic magnet, voice coil, spider, basket, cones, eight-page construction manual, and blueprints for matching enclosure. Two sizes: 8", \$15.95; 12", \$19.95. Radio Shack Corp., 730 Commonwealth Ave., Boston.

**Plug-in battery charger** provides power to operate a transistor radio on house current and recharge the battery at the same time. Built-in transformer guards you against shock. Polaris 69 is \$6.95. VRL Electronics Corp., Michael Dr., Syosset, N.Y.





**This FATHER'S DAY  
give HALF AND HALF!**



# HE'LL LOVE THE FLAVOR...AND EVERYONE WILL LOVE THE AROMA!

- When Dad lights up a pipeful of HALF AND HALF, the people around him enjoy it almost as much as he does. That's because no other pipe tobacco has such a delightful aroma—and such a distinctive taste.
- HALF AND HALF is a mixture of choice aromatic tobaccos... specially selected and blended for mild taste and friendly aroma. So this Father's Day give your pipe smoker HALF AND HALF.
- Buy famous HALF AND HALF in vacuum-packed humidor tin or the convenient pocket pouch.



**SHOW THIS TO YOUR  
BETTER HALF—SHE'LL  
LOVE THE AROMA OF  
HALF AND HALF!**

**A CARGO OF CONTENTMENT IN THE BOWL OF ANY PIPE!**

©THE AMERICAN TOBACCO COMPANY



# New KODAK

# MOTORMATIC



## ...10 SHOTS

**Most automatic of all 35mm automatics!**

**Now with built-in flash, it's the most complete automatic!**

The KODAK MOTORMATIC 35F is your kind of camera—your hand gets the fit and feel of it quickly, like a fine tool or gun. Wind the motor drive, sight your photo target, and rapid-fire 10 pictures in a row without taking the camera from your eye. Or, snap off a shot at a time—this camera always keeps you ready for your *next* shot.

This most complete of the automatic cameras takes care of details, lets you concentrate on taking pictures. Electric eye automatically sets the fast  $f/2.8$  lens to suit your choice of shutter speeds, from  $\frac{1}{40}$  to  $\frac{1}{250}$ . A low-light signal in the big viewfinder warns when light's too dim.

And here's a welcome surprise! Flick a button and the flash reflector flips open, ready to take an AG-1 "peanut-size" bulb. As you aim and focus for flash, you *automatically* dial the correct exposure setting from 5 to 25 feet.

All by itself, the KODAK MOTORMATIC 35F Camera does the jobs of many separate accessories. With film and a pocketful of "peanut" bulbs, you're ready to get the picture—any time, anywhere!

Less than \$120 buys you this most complete of the automatics—with two high-energy batteries and special flashguard. See it at your Kodak dealer's soon.



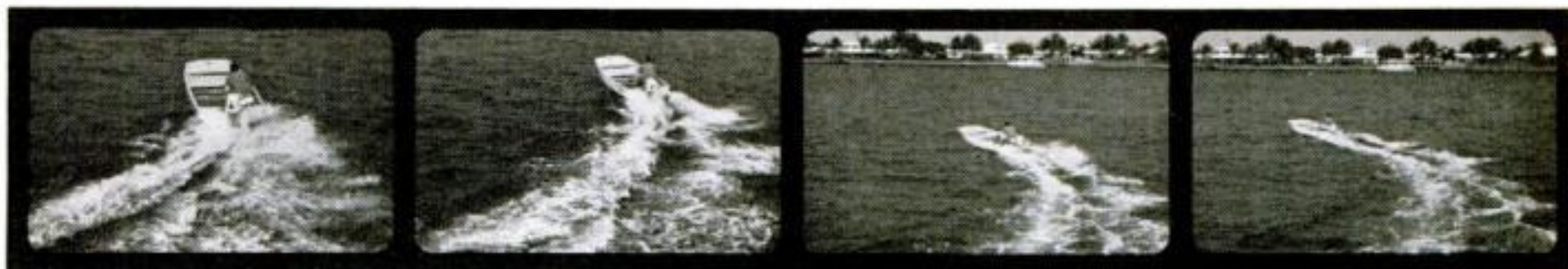
# 35F Camera Catches Skid Test!



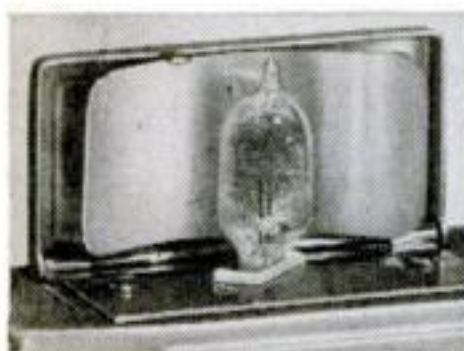
**POWER DRIVE** lets you take a 10-shot sequence in 10 seconds . . . without lowering the camera from your eye. Power drive cocks shutter, advances film, counts exposures.



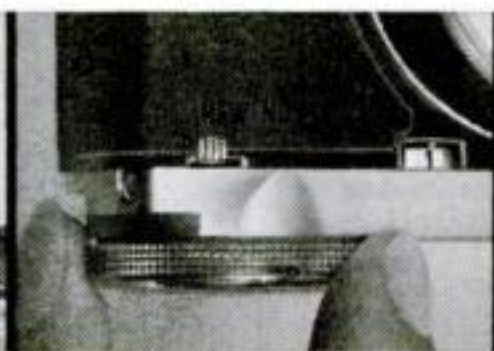
**FOLLOW THE ACTION...** capture it! Even while you're shooting, the electric eye analyzes the light, automatically feeds any necessary corrections to the lens.



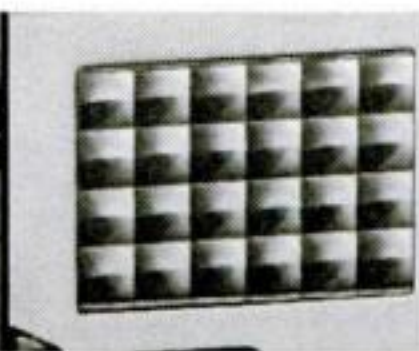
# IN 10 SECONDS!



**POP-UP FLASH** • Flick a button—and flash unit flips open to take AG-1 bulb. A dozen fit in your shirt pocket! Automatic flash control sets lens as you focus!



**POWER DRIVE** • Wind—and you're ready to rapid-fire 10 shots without lowering camera from your eye. Power cocks shutter, advances film, counts exposures.



**ELECTRIC EYE** • Automatically sets fast  $f/2.8$  lens. When light fades, low-light signal in viewfinder suggests you try a slower shutter speed or flash.



**LENS** • Fast KODAK EKTAR  $f/2.8$  Lens—the keen-eyed Kodak quality you want for brilliant color shots.

*Price subject to change without notice.*

**EASTMAN KODAK COMPANY, Rochester 4, N. Y.**

Enjoy Walt Disney's "Wonderful World of Color" Sunday evenings, NBC-TV

**Kodak**  
TRADE MARK



**what's new**

## in TOOLS

Unbreakable trouble light seals an 11" fluorescent tube in a shock-absorbing plastic-and-rubber housing. You can drop it, step on it, or dunk it in cold water without shattering or shorting. KH Safety Lamp, \$19.95. Magnetic holder, automatic rewind reel, and inverter for battery use are extra. K & H Industries, Inc., Angola, N.Y.

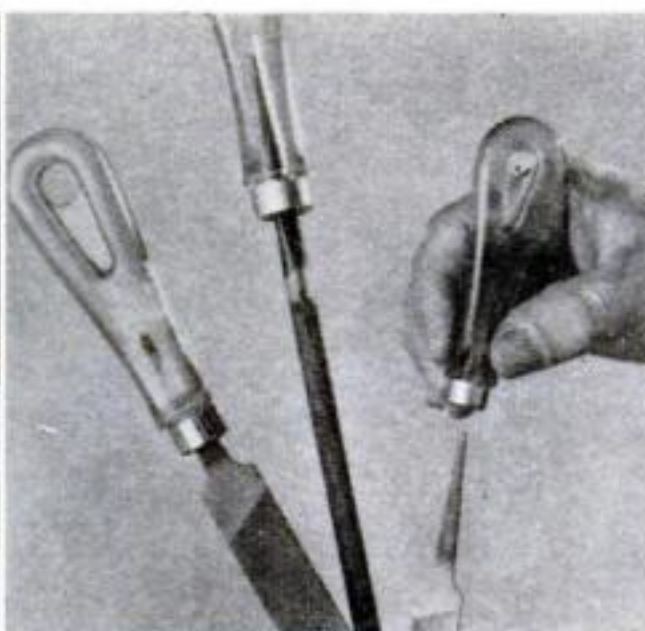


"Dial-the-cut" dado head will rabbet or groove any width from  $\frac{1}{4}$ " to  $\frac{1\frac{3}{8}}$ " when you spin the rotating body to set it for the desired reading on a calibrated scale. With high-speed steel bits brazed to the body, the dado cutter is \$19.95. There's a carbide-tip model for plywood, too. Boice-Crane Co., 944 W. Central, Toledo, Ohio.

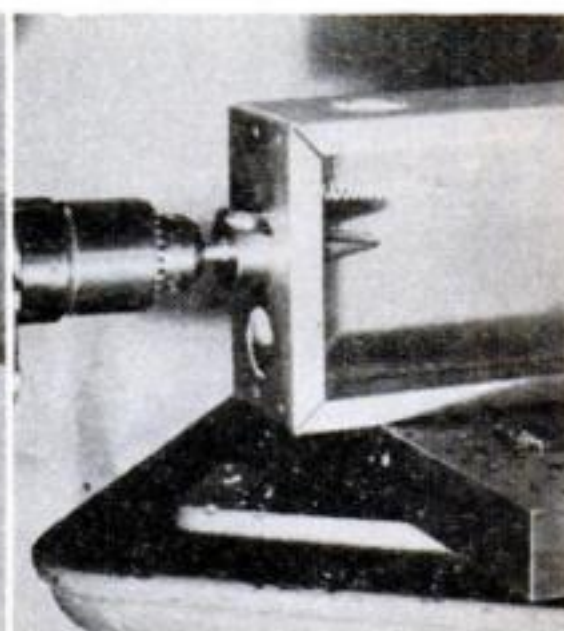
►►► Built-in bubble level in  $\frac{1}{2}$ " power hand drill enables you to start hole at exact 90-degree angle in wall or vertical work. D-1 Dot has geared chuck. Price, \$16.95. Diston Div., Porter Bldg., Pittsburgh.



Punch-and-die combine adapts a drill press to cut any design in sheet aluminum (up to 16 gauge), or in cold-rolled steel (to 18 gauge). You can cut any size work if outline falls within CA-Nibbler's 2" throat. \$39.50. Super Products Co., 411 Eichelberger St., St. Louis.



Plastic file handle of Ten-ite acetate has hole in end for hanging to prevent tooth wear from contact with other tools, can be used on new files as old are thrown away. Three sizes: 40, 55, and 65 cents. Geo. Cluthé Mfg. Co., Waterloo, Ont., Canada.



Cone drill cuts any size hole from  $\frac{1}{8}$ " to  $1\frac{1}{4}$ " in relatively thin material. You scribe diameter required, and drill to scribed line. When used on sheet metal, bit removes a continuous chip, leaving no burrs. It sells for \$8.50. Scully-Jones & Co., 1901 S. Rockwell St., Chicago.





Imagine the pride and excitement of building an attractive patio or deck . . . *plus* a beautiful fence. West Coast Lumber makes it a simple task with two new colorful planning booklets—*Fashions in Fences* and *Patios 'n' Decks*. Both are filled with illustrations and ideas on everything from styling to framework . . . both can help *you* beautify your home. Ask for your FREE copies at your Retail Lumber Dealer . . . or mail the coupon below.



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Please send me the booklets checked below.

☐ Patios 'n' Decks ☐ Fashions in Fences

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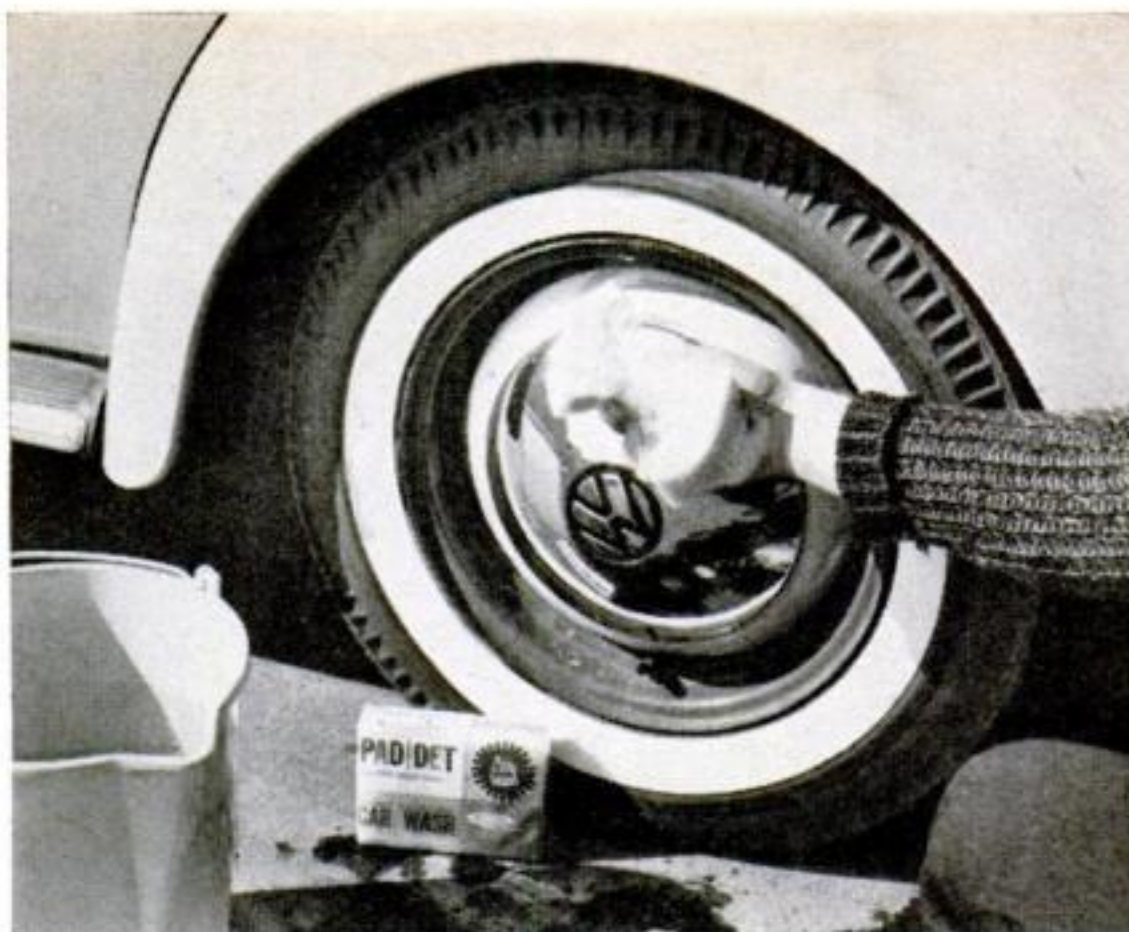
Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_



## what's new for your CAR

**Car-wash sponge** is plastic foam with enough built-in detergent to wash your car or station wagon four times. When it stops sudsing, you can use it with other cleaner. Similar sponge saturated with silicon oils will shine car, outdoor grills, or shoes. Wash sponge costs 59 cents; shine, 69 cents. Whirlpool Corp., Benton Harbor, Mich.

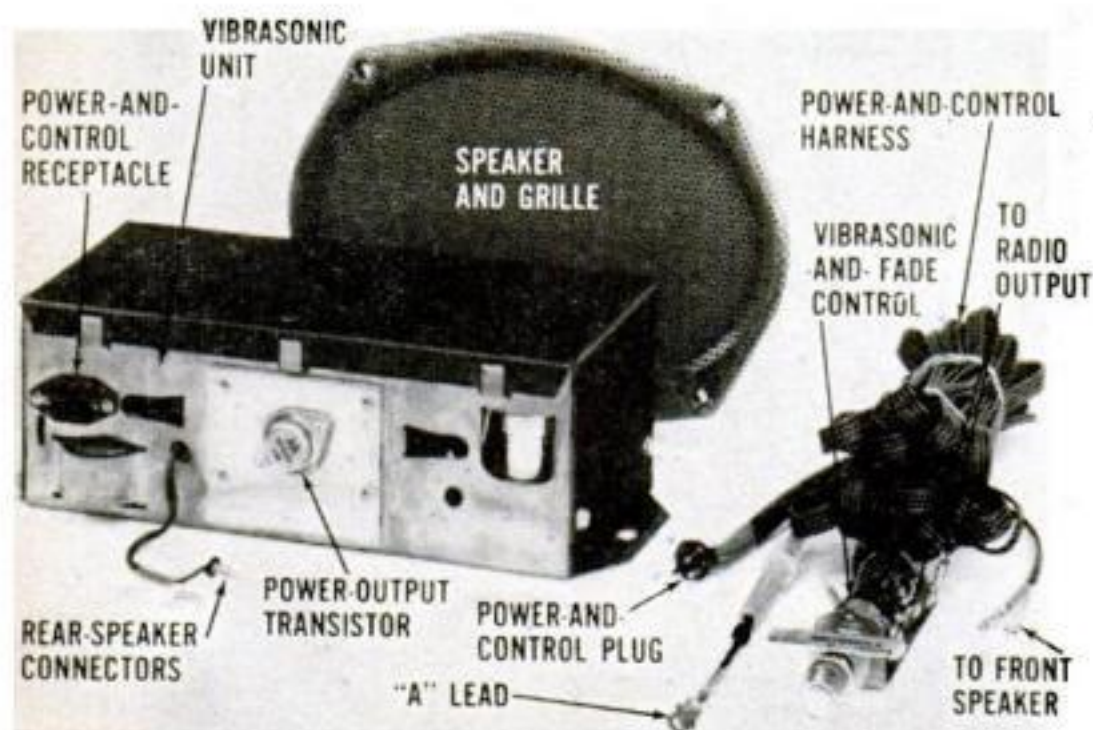


**Fuel-line lock** shuts off gas from carburetor to prevent theft or unauthorized use of your car. Key unlocks cover, and slotted head in concentric-tube locking mechanism is opened with back of key. \$6.95. Wise Lock Co., 16609 Harvard, Cleveland.

**Cigarette snuffer** has ring-magnet base that clings to steel mount cemented to dash. It snubs out sparks before you discard cigarette. Hold snuffer out window and wind blowing through cleans it. \$1. Sorrell Mfg., 364 Elmwood, Rocky River, Ohio.



**Miles-per-gallon meter** measures relative fuel consumption at all speeds. The two-part electronic instrument has an indicator (right) mounted above the dashboard, and a transducer in the engine compartment with three connections. You're saving gas when you drive so indicator registers on green side of scale, wasting it when the pointer goes to red. \$24.95. Drivers Guide Co., 19 Tyler Rd., Lexington, Mass.



**Reverberation attachment** is said to produce livelier and more vivid sound from a car radio. By delaying a portion of received signal a fraction of a second, the Vibrasonic system simulates concert-hall acoustics in your car. Kit contains all parts and instructions you'll need to add it to any 12-volt, negative-ground car radio. It lists at \$29.95. Motorola, Inc., 9401 W. Grand Ave., Franklin Park, Ill., is the maker.



# DU PONT M.O.A. GUARDS YOUR CAR ENGINE AGAINST DANGERS YOUR OIL INDICATOR DOESN'T SHOW!



***Exclusive Du Pont development prevents harmful sludge formation...helps keep oil passages open...saves costly engine repairs***

Sludge is your engine's worst enemy. It doesn't register on your oil-pressure gauge or trigger your warning light until it's too late. But whenever you drive, sludge can form . . . blocking oil passages, clogging key engine parts, robbing your engine of vital lubrication. Result: valves become noisy, rings stick, engine wear increases . . . and repair bills rise.

Du Pont M.O.A. added to your motor oil prevents sludge from forming. Just one can of M.O.A. at each oil change keeps your engine cleaner, quieter and smoother-running, under all driving conditions.

Don't let deadly engine sludge give you low performance and high repair bills. Add Du Pont M.O.A. to your crankcase regularly. Available at service stations or wherever auto supplies are sold. Just \$1.65.\*

\*Suggested retail price

## **Results of 48,000-mile road test**



**OIL SCREEN WITH M.O.A.**



**OIL SCREEN WITHOUT M.O.A.**



**DU PONT No "7" PRODUCTS**

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY

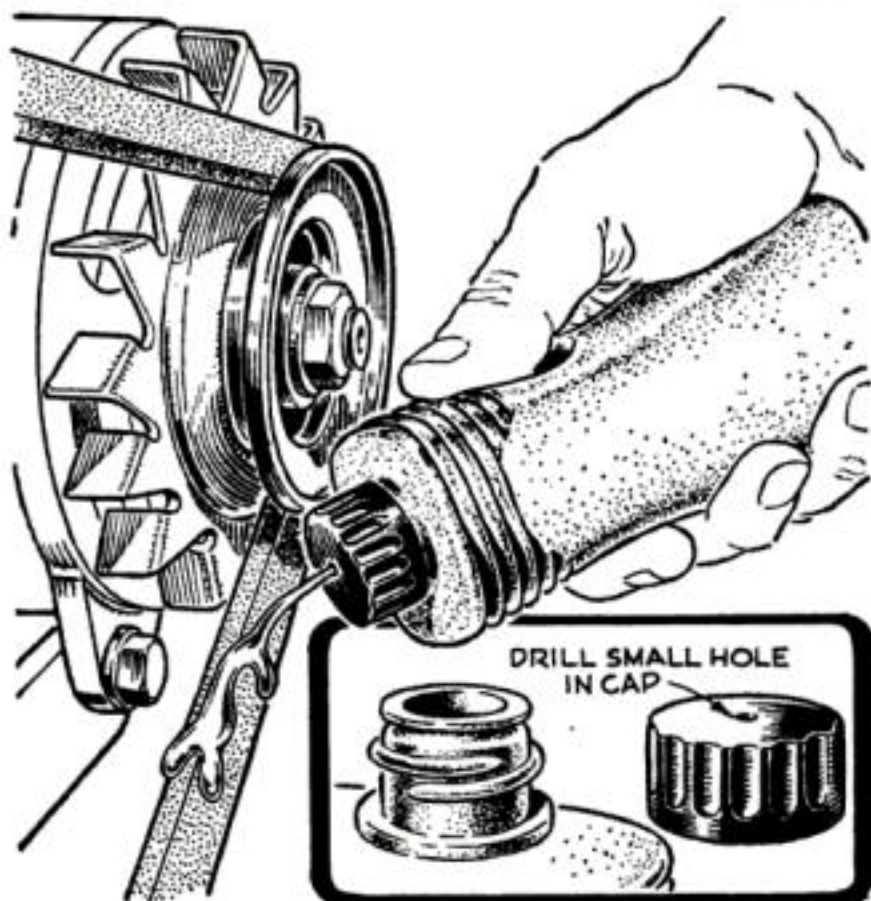




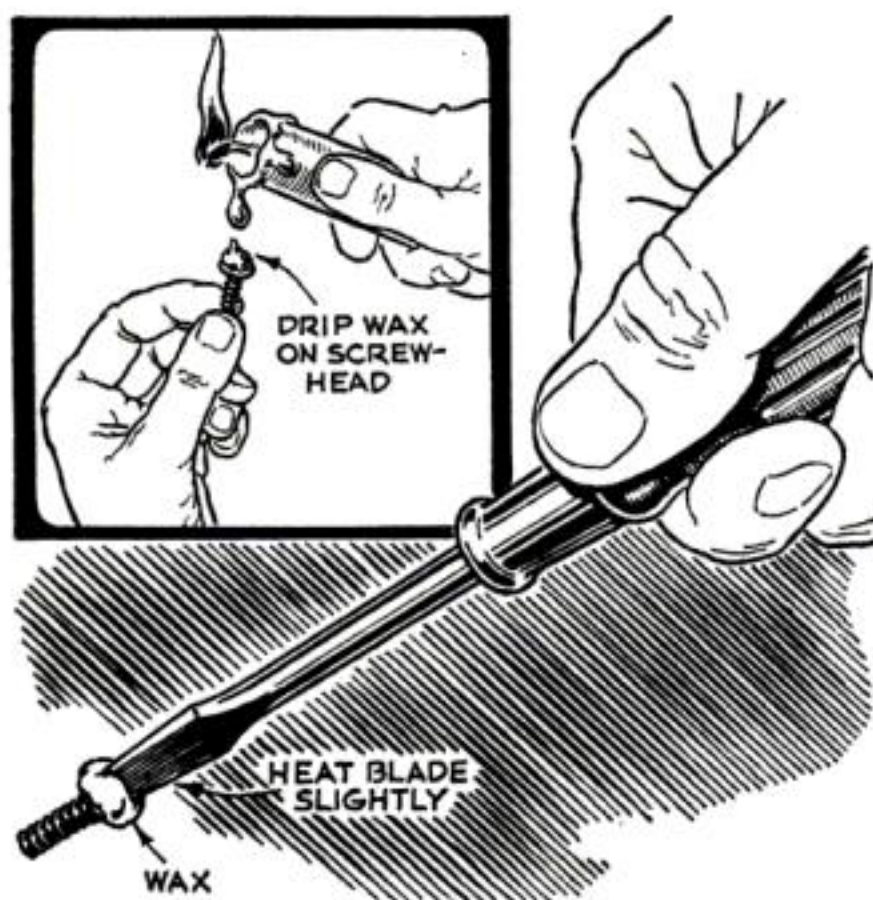
# Hints from the Model Garage



Drivers who forget to dim are a hazard. To avoid being blinded by a closely trailing car, form the word "dim" with reflector tape on the passenger's-side sun visor. Flipping down the visor gently reminds the offending driver that his high beams are on.



Squirting belt dressing or oil into hard-to-reach spots is easy with a plastic liquid-detergent container. Drill a small hole in the cap, and fill the container with oil or any other liquid you want to spray. To squirt, just squeeze the sides of the bottle.



Starting a screw by hand is difficult if it's behind a dashboard or in other confined areas. Here's one way to make the screw stick to the screwdriver blade: Drip candle wax on the screwhead, heat the blade slightly, and press it into the screw slot.



Whitewalls come out whiter than new when cleaned with a small wire brush and powdered household cleanser containing bleach. Wet the tires before scrubbing them. To prevent damage to the rubber, carefully rinse off all the cleanser afterward.





Pat Pigott, in his Champion-sparked Rosebud Racing Team Lotus, winning the Formula Junior race at Sebring, Fla.

Winners of 9 out of 10 major races  
use Champion spark plugs  
because Champions have no equal  
for performance!

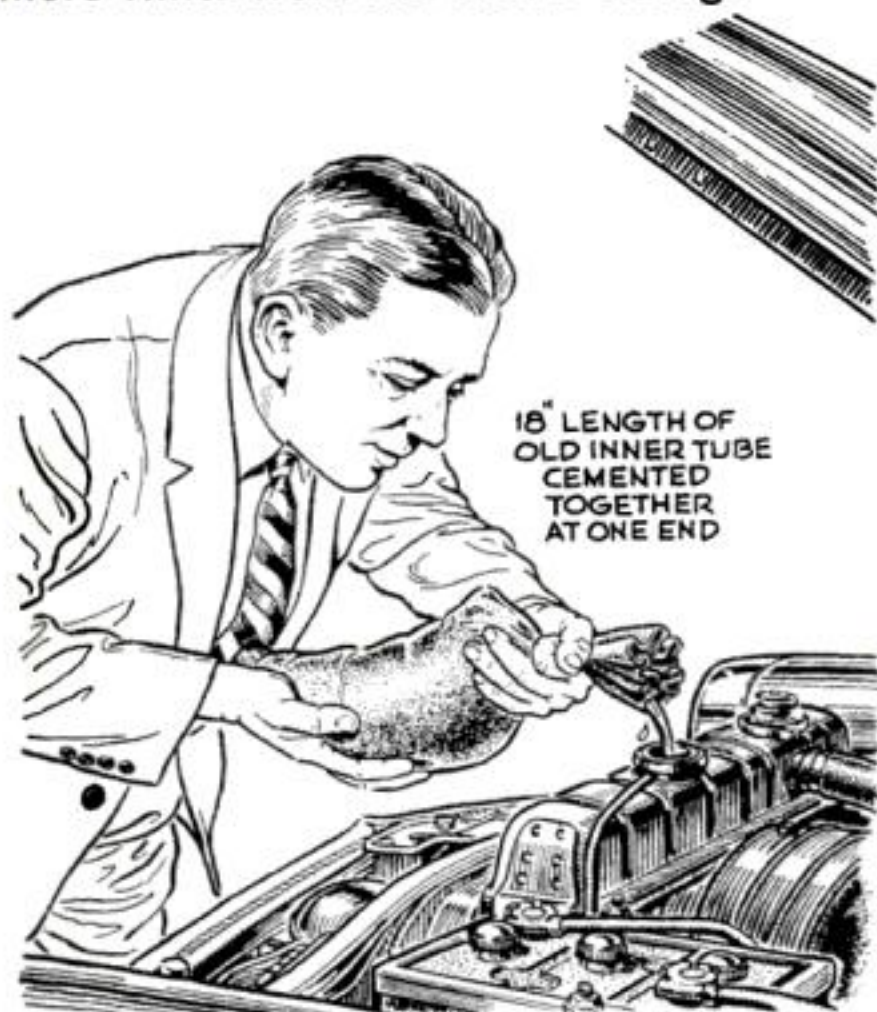
Why settle for less in your car?



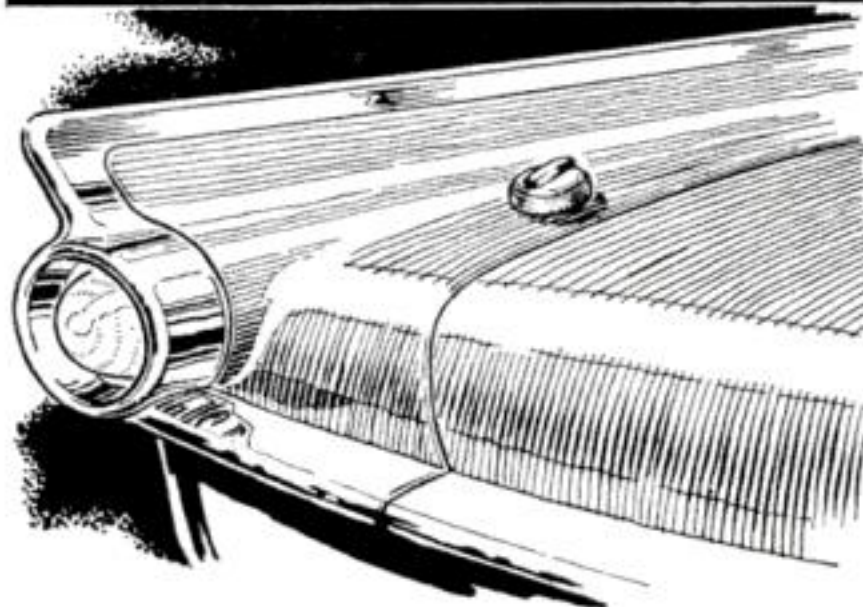
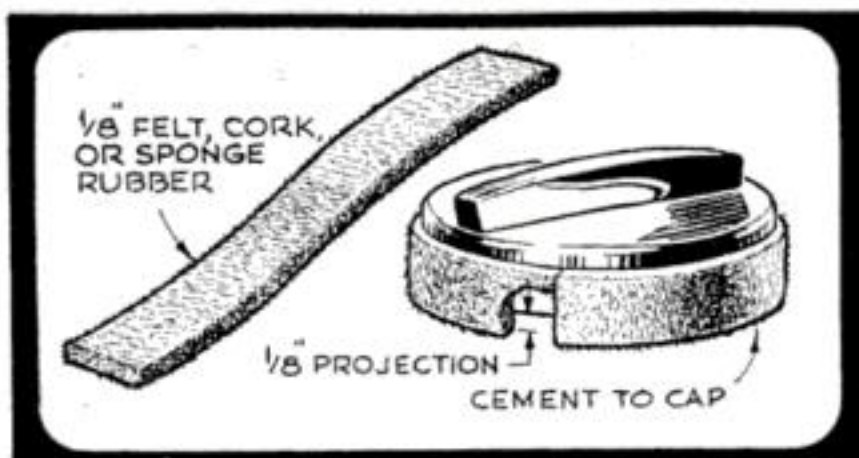
**CHAMPION**



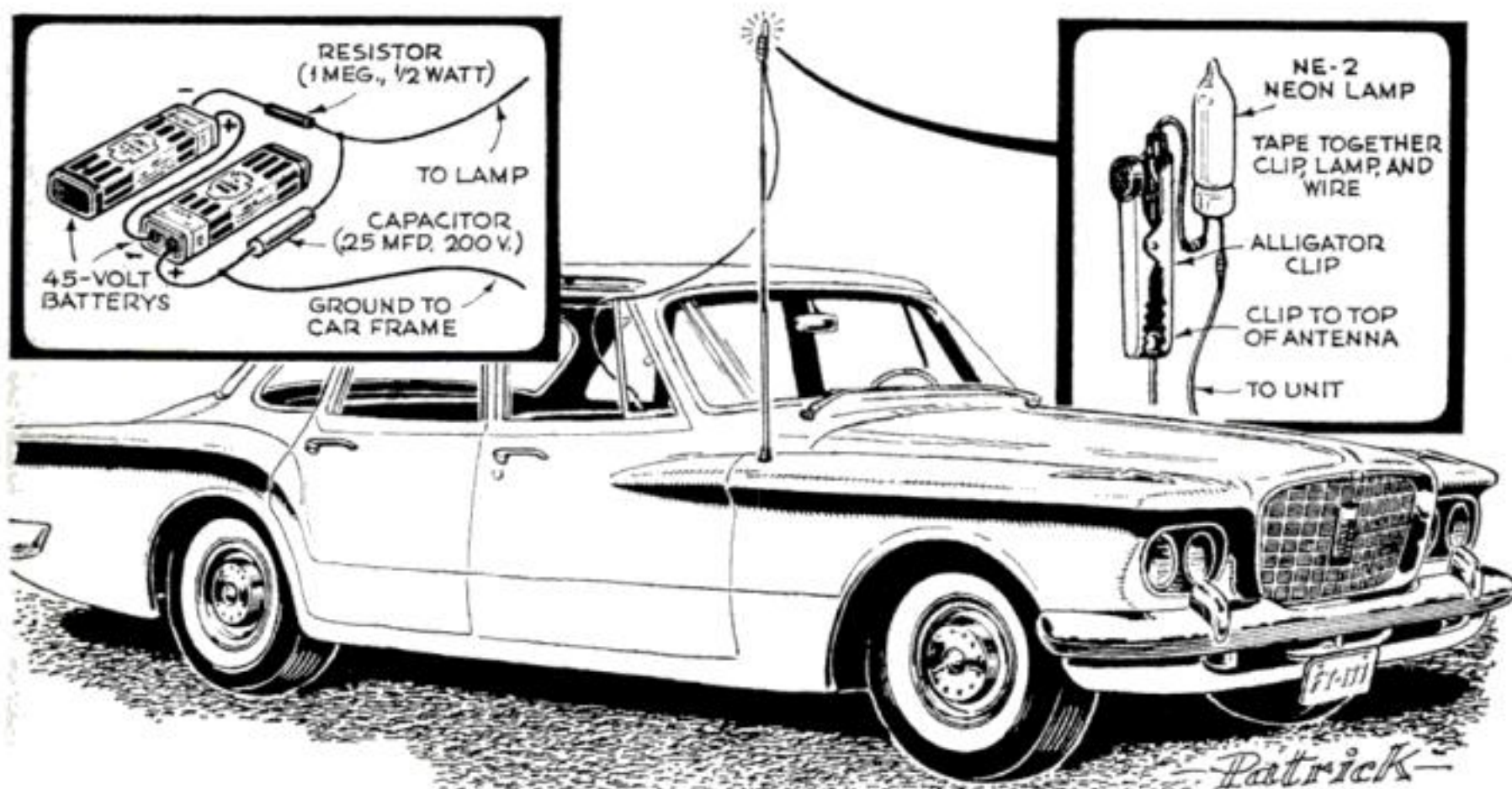
## More Hints from the Model Garage



If your radiator boils over, an 18-inch section of old inner tube cemented closed at one end makes a handy refiller. Use it to carry water to your car from a nearby stream or tap. When not in use, the flexible bucket rolls up for compact storage.



Collar your gas cap with a strip of foam rubber, cork, or felt glued in place. It will keep the car paint from being scratched by pumpmen who plunk the cap on a fender or deck lid. Extend the strip  $\frac{1}{8}$  inch below the cap's base to act as a cushion.



Finding your car at night, particularly in a big parking lot, can be a problem. But this tiny antenna light will guide you to it every time. You'll need two 45-volt batteries, a resistor, a capacitor, and a length of small-gauge insulated wire running to a neon bulb

on an alligator clip. When you leave your car, snap the clip to the top of your antenna, close the window over the wire, and connect the ground lead to the dash or any other handy part of your car. The power pack can be kept in the glove compartment.






# ac·cel'er-a'tor

One who or that which accelerates; specif.:

**a** On automobiles, a foot-operated throttle. **b** (*pron.* ak-sel'er-a'ter; *L.* ak-sel'er-a'tor) *Anat.* Any muscle or nerve that hastens a motion. **c** *Chem.* A substance that hastens a reaction. **d** *Physics.* Any device used to impart high speeds to charged particles. (Webster's New Collegiate Dictionary)

 All the above is true, as far as it goes. What it doesn't say is that an Impala Super Sport has even more going for it than performance. It's a swinging car in every way. Bucket seats, special interior, distinctive exterior trim, all part of the Super Sport kit, optional at extra cost on Impala Sport Coupes and Convertibles, and it proclaims to the world that this machine doesn't take a back seat to anybody. To understand, you'll just have to try an Impala Super Sport, that is, step on that accelerator. You'll be impressed, or our name isn't Chevrolet Division of General Motors, Detroit 2, Michigan.

## CHEVROLET IMPALA



# Gus Puts In a Plug for the Teen-Agers

By Martin Bunn

FROM the 11-year-old sedan stepped a wisp of a man who couldn't have weighed much more than the spare tire. Hatless, he wore a fringe of white hair above a ministerial collar.

"Good morning," he said to the owner of the Model Garage. "I am the Reverend Dinwiddy. On the way here from Mill City my car began to whine. My boys think it's a dry wheel bearing."

"Can you leave it?" asked Gus.

"Yes, indeed. We'll be at the old Brace mansion. It's being torn down, and we're salvaging the paneling for my church."

"I'll bring the car over about four o'clock," promised Gus.

"That will give us ample time to load our loot," said Dinwiddy, pointing to a luggage rack on the sedan.

Stan checked the wheel bearings at Gus's request. "Look good to me, Boss," he reported a short time later.

"Guess I'll have to road-test her," Gus said, getting into the old car. On the road, all seemed normal until, at 30 m.p.h., a keening wail began. Gus stopped to inspect the radiator for loose fins or a plugged core hole. Finding nothing, he removed the fan belt. With the fan, water pump, and generator immobilized, he drove on a short way.



*Stan countered with an uppercut. The youngster two-stepped backward and sat down.*

The noise was even louder than before.

Back at the shop he inspected all manifold and exhaust connections, listened to the transmission and differential with the wheels running on jacks. There wasn't a whisper of a whine in any gear.

AT FOUR o'clock, Gus parked the car behind a house-wrecker's truck and approached the Brace house. The little minister staggered out under a load of oak paneling. A husky teen-ager with another load paused behind him.

"Find the trouble?" asked Dinwiddy.

Gus shook his head. "I've never run across anything just like it. Your wheel bearings are okay—and so is everything else we've checked so far."

The youth shoved past the minister aggressively and turned toward the street. The boards he carried swung around, their ends brushing Gus's shoul-





der enough to jar him. Dinwiddy gasped in dismay.

"Are you hurt? Ted is an impatient type—and hungry for supper, I think."

"No harm done," Gus assured him. "One of your boys, Reverend?"

"In a way—I am chaplain for the Mill City Corrective Home for Boys. Four of the boys volunteered to help me. Though they are considered difficult youngsters, we get along well."

"I'd like another look at your car, if you're coming back tomorrow," said Gus.

"No, not tomorrow. I promised to let the boys use my car a few hours." The little man suddenly looked worried. "They didn't say for what."

"Any day you can, then," said Gus.

**S**TAN was near the door next morning when a chorus of yells and grunts drew his attention. Four boys were pushing Dinwiddy's car to the pump.

"Fill 'er up," ordered the biggest. He lit a cigarette as Stan put the hose nozzle into the tank neck. Gas gurgled in. At six gallons, the automatic nozzle shut off. Stan removed the hose.

"I said fill it," growled the boy.

"It won't take any more," replied Stan.

"Tank was empty, you jerk," snapped the other. "Why d'you think we pushed it in here? Gimme that!"

He lunged for the hose, cigarette in one hand. Stan straight-armed him and hung the hose on the pump. Furious, the boy swung for Stan's midriff. Stan blocked the blow, countered with a brisk uppercut. The big youngster two-stepped backward and sat down. Gus arrived, but the fight was over.

"He owes for six gallons," Stan muttered. "Wants more—but the tank is full."

A siren wailed at the corner, bore down screaming. The fallen boy got to



his feet. The four looked at each other, then ran off through the alley.

The siren died to a moan as Chief Eldon's police car pulled up. Eldon walked around the back of Dinwiddy's car, pausing a moment to bend down behind it.

"I'm looking for an old black sedan with three hefty boys," he said.

"Four pushed this car in," Gus answered. "What did the three do?"

"Could have been four," said Eldon in his mournful drawl. "One may have stayed behind the wheel. They broke open some 50-cent meters in the all-day parking lot at the railroad station less than 10 minutes ago. Nobody's around there, once the lot's filled and meter patrol's done, till the commuters come home. Our one witness says the car was bucking and barely got away. Call me if it shows, Gus."

Eldon drove off, his siren silent.

"Boss, it fits!" said Stan. "Those kids emptied the meters, then

the car conked out on the getaway . . ."

"Whoa!" cautioned Gus. "I don't know why, but Chief Eldon doesn't think so."

"Then why'd they scam like that?"

"They're from a corrective home," said Gus, getting into the car. "To them, cops spell trouble. The running is sort of automatic."

He tried the starter; there wasn't a pop of response from the engine. Together he and Stan pushed the car aside.

**A**N HOUR later a timid step entered the shop. The Reverend Dinwiddy's thin hair seemed to bristle with anxiety.

"Do you know where my boys went?"

"They didn't say," answered Gus.

"A workman coming back to the Brace house after lunch saw my car here. He also told me of the parking-meter thefts. I must confess I'm a little worried about the boys."

"I don't think they robbed those meters," said Gus. "But you can ask them yourself, because here they come now."

Stan joined Gus and the minister as the boys sheepishly approached. The

tall one held a clenched hand out to Stan.

"Here's one-eighty for the six gallons. Sorry I slugged you."

"Okay," grunted Stan. "We're even."

The smallest boy turned to Dinwiddy. "The workmen at the house said you came here to look for us. We heard about the meters. It wasn't us, Rev."

"We just wanted to surprise you," put in a third boy. "We borrowed your car to give it a good tune-up. We bought a condenser and new points and plugs and drove over here to put 'em in. Worked behind that

fence the wreckers put up, so you wouldn't see. Only we never did time the engine, 'cause it run about a minute and quit."

"We figured we was out of gas," finished the tall boy, "because your gas gauge don't work. But just after we got some, that cop sort of bugged us . . ."

A car screeched to a stop at the curb. It was Chief Eldon back again. Taut as guitar strings, the four boys seemed on the verge of flight.

"Only the wicked flee where no man pursueth," said Dinwiddy with a twinkle in his eyes. "Stay put."

"Want me to see whether I can find your trouble?" Gus asked the boys, as

### Where'd it come from?

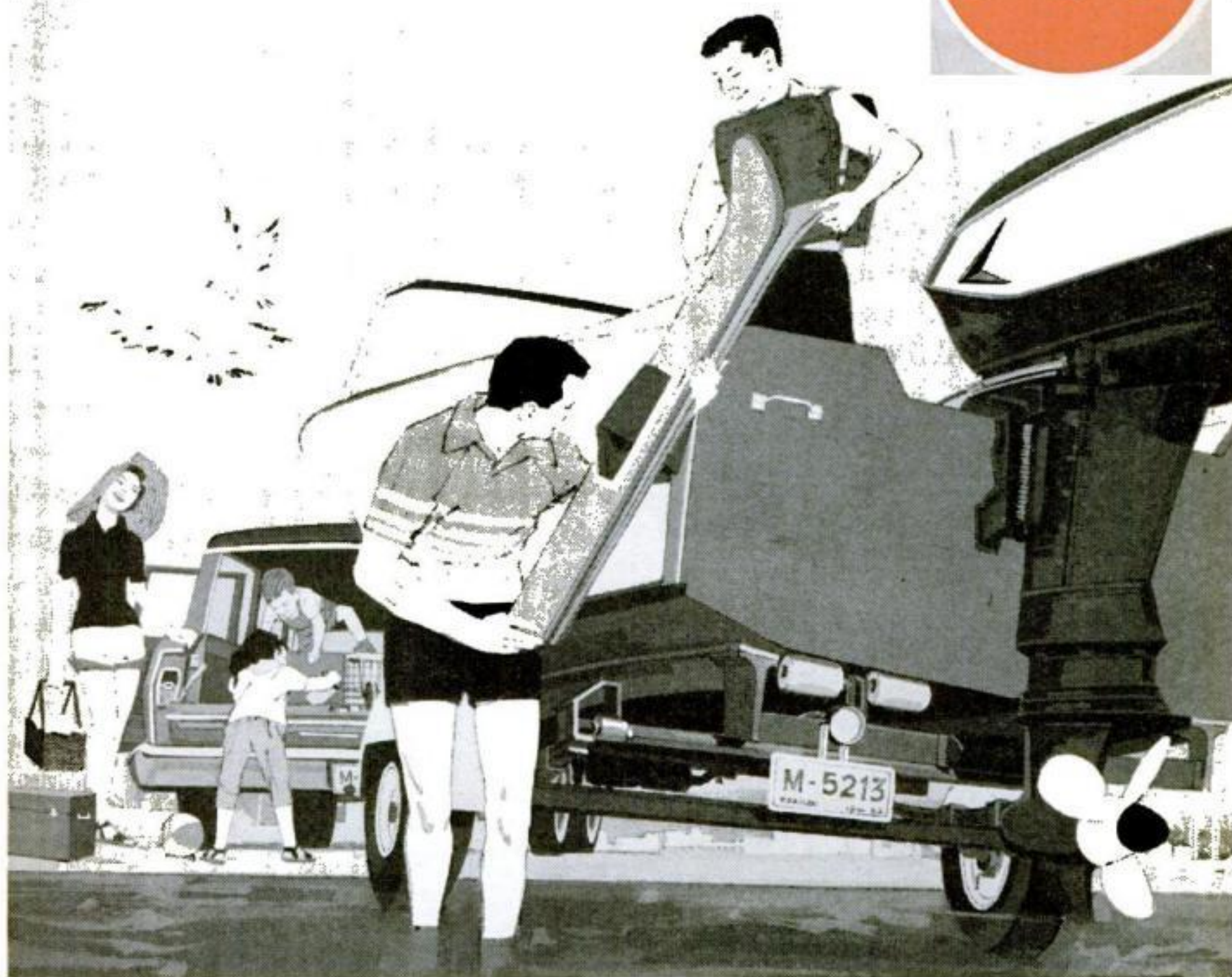


### Ship's Time

In the days of Columbus, watches were unknown. To keep time aboard ship, hour-glasses were used. It was the job of young boys to turn the glasses, each of which ran for half an hour, and to report to the captain that they were on the job by sounding bells. In this way, a half-hour became one bell, an hour two bells, and four hours (the end of a watch) eight bells. The day began with eight bells for midnight and continued in cycles of four hours each day.



*sure-fire*  
**you get A**ct**ion with**



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 with new AC Fire-Ring Spark Plugs**



You can count on sure-firing spark plug action in your car and boat all summer long by installing AC Fire-Ring Spark Plugs now.

ACs are built to deliver maximum performance and reliability wherever they are used. They have such extra quality features as the exclusive AC Hot Tip insulator that resists misfiring by burning off fouling deposits as they form—massive electrodes of special alloy that resist

erosion and wear—heat bonded inner seals that positively protect against gas leakage and overheating. In addition, AC Marine Spark Plugs give you special boating benefits such as waterproofed packaging, rust-resistant finish and spin-on gasket.

You'll get best action from every engine you own by installing new ACs. Ask for A**ct**ion . . . ask for AC!

AC SPARK PLUG  THE ELECTRONICS DIVISION OF GENERAL MOTORS



**FIRE-RING SPARK PLUGS**



Eldon sauntered over and saluted Gus.

Four heads nodded. Gus inspected the distributor cap, rotor, points, and condenser connections. All were in order. He switched on the ignition and flicked the points with the coil wire held near the block. A spark flashed.

**R**EPLACING the distributor cap, he pulled a plug cable free and held it near the block. A spark snapped

the valves lifted under the plugs, they hammered the electrodes over, until the spark gaps were closed. That shorted out the spark, and the engine stopped.

"Could you put in the right plugs, Mister?" the big boy asked. "We'll pay."

"I'll swap plugs with you," offered Gus. "We can regap yours good as new."

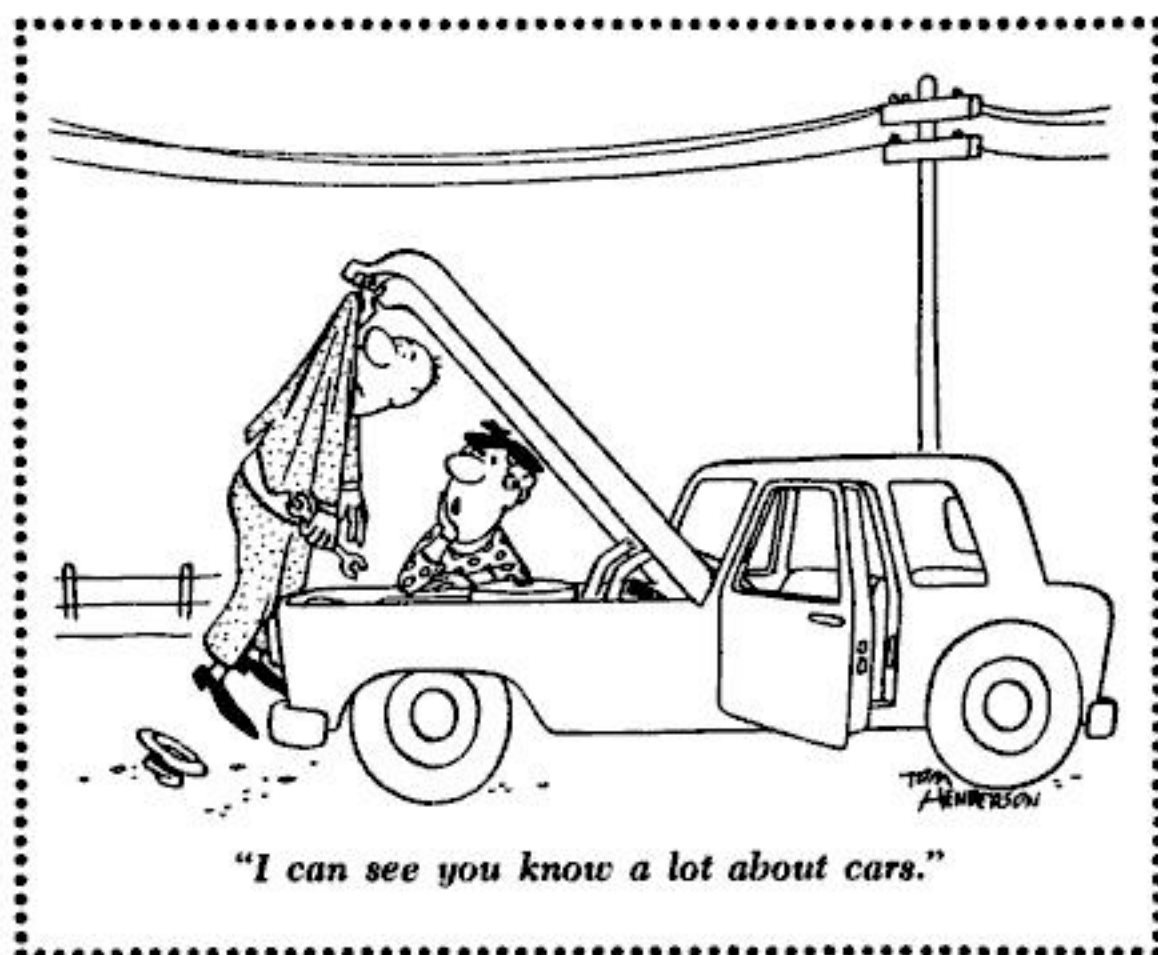
As the boys started removing plugs, Gus took the Chief and Dinwiddy aside.

"Satisfied, Chief? They couldn't have driven from the station with those plugs."

Eldon scratched his neck. "Who said they did? I came to tell you we caught the thieves."

"Oh," muttered Gus. "Tell me something else. Somebody must have reported seeing the boys push the car here. The description matched, so you rushed over. What told you it was the wrong car?"

"Nothing as fancy as your shorted plugs, Gus," said Eldon dryly. "I just felt the tailpipe. It was stone cold."



across as he cranked the engine. Maybe it was fuel failure, after all, Gus thought.

But the automatic choke was properly closed, and an odor of raw gas testified that some fuel was reaching the engine. Again Gus pondered the possibility of ignition trouble. That didn't seem likely either, since he'd just proved there was a hot spark right up to the plugs.

New plugs, too—now that, he suddenly realized, could be the trouble. He unscrewed one and looked at the tip.

"You know what plug this engine's supposed to take?" he asked a boy.

"Sure, a J11. But they didn't have that number, so we took the nearest to it—J12Y."

"That's one way to figure," remarked Gus. "It just happens to be wrong. You see, these plugs have extended tips. They go too far into the cylinder. Every time

**N**EXT morning, the Dinwiddy car stopped again outside the shop.

"About that noise," Gus asked the minister. "I meant to ask you—do you hear it when you're driving home?"

"Only on the way here."

"Know what I think?" mused Gus. "When that roof rack isn't loaded, the wind whistling through its channel members makes them vibrate and whine."

The minister pointed to the bare car roof. "That's what I came to tell you. Yesterday I took off the carrier, and the noise disappeared. Then last night I was working on my sermon and Saint John gave me the answer."

"He was a mechanic, too?"

"Not quite," replied Dinwiddy. "But he gave me the text of my sermon: 'The wind bloweth where it listeth, and thou hearest the sound thereof.' I saw a great light," he finished, chuckling. ■ ■



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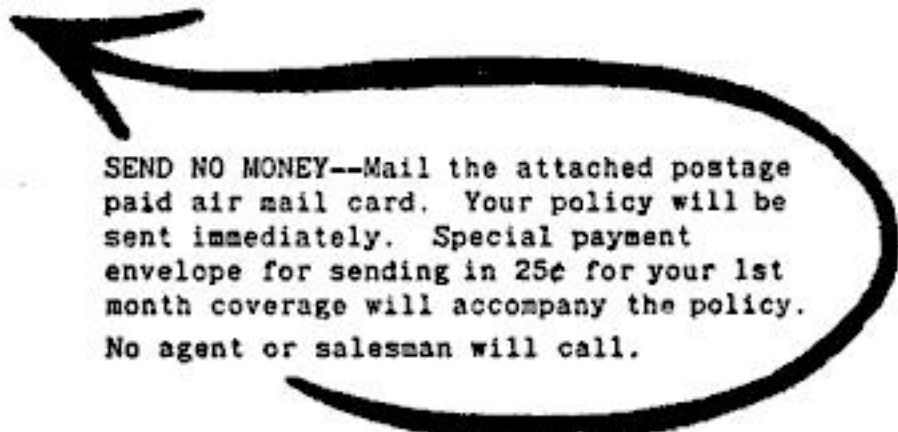
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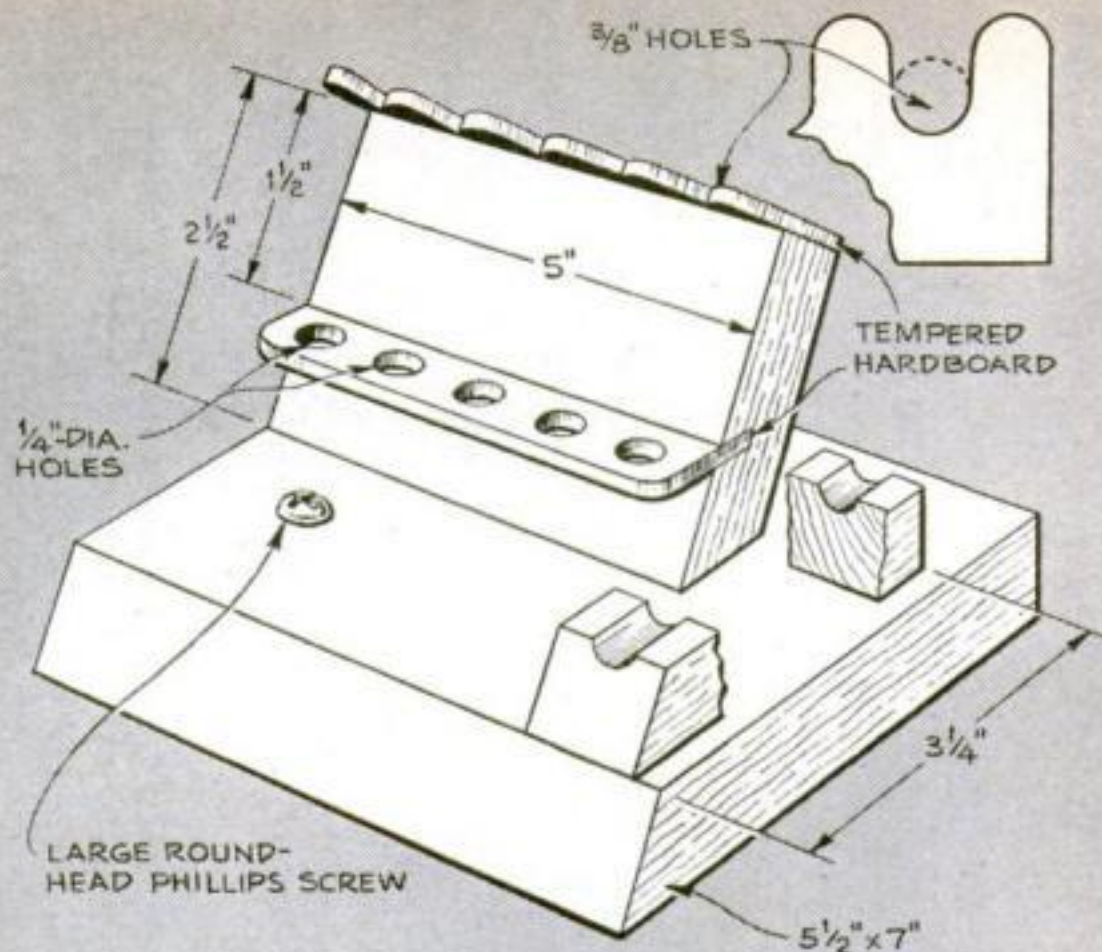
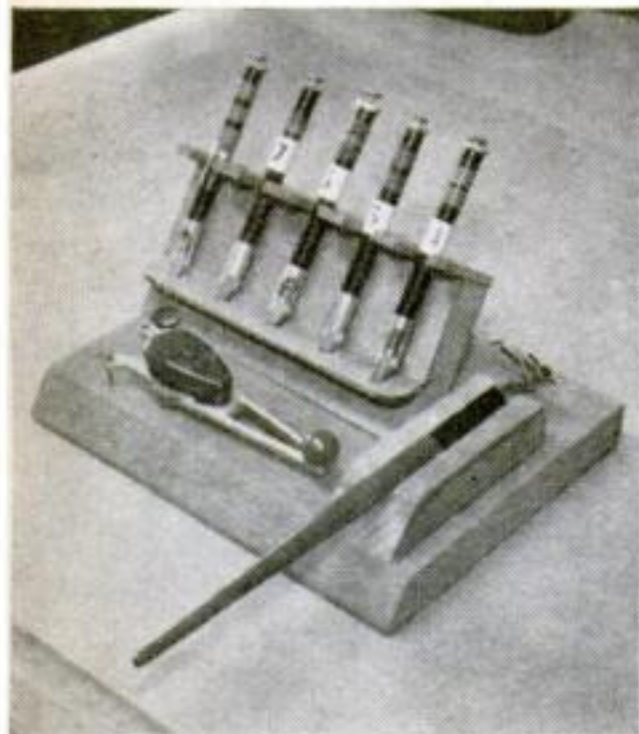
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## Short Cuts and Tips

FROM PS READERS

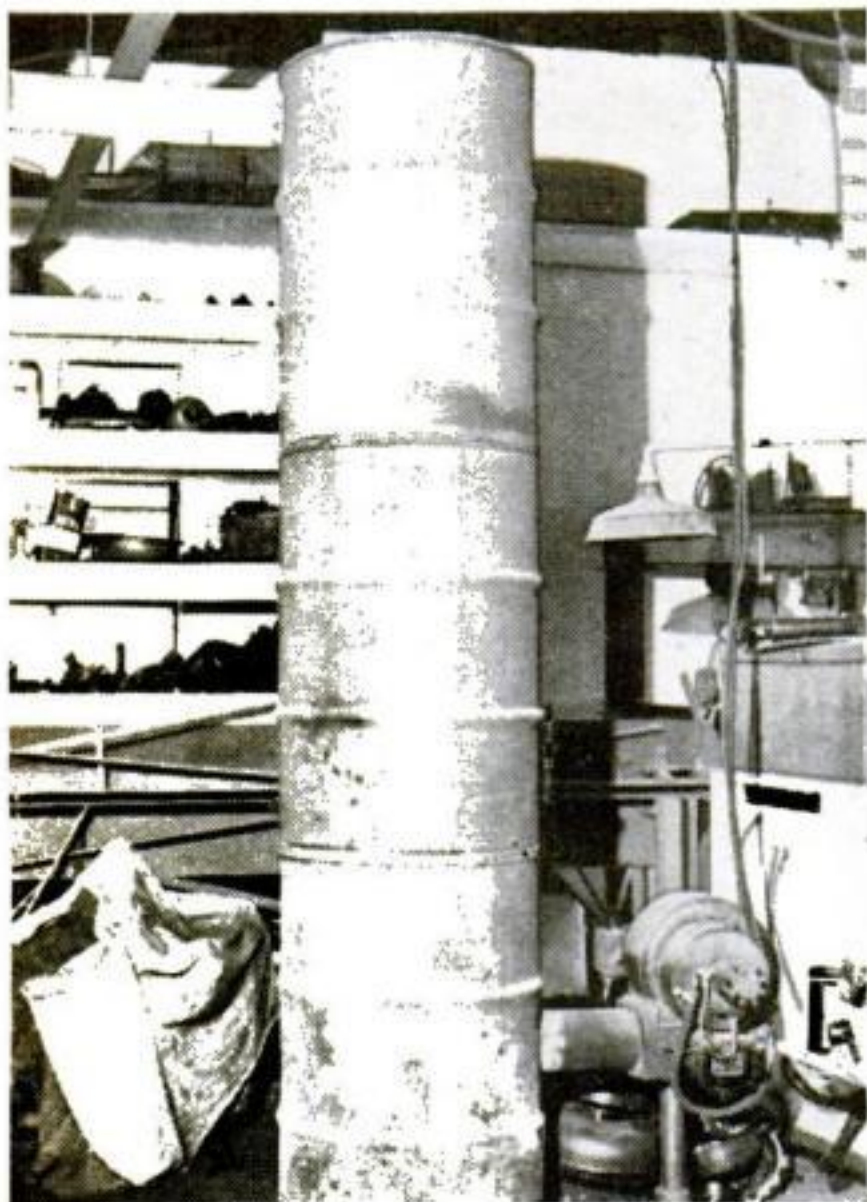


### Pen rack for a drawing board

It's risky to lay a drafting pen on the slanted surface of a drawing table: It may roll over your drawing, trailing a smear of India ink. This rack prevents such accidents, and also keeps a selection of clean-pointed pens within easy reach.

Five Wrico pens stand in a bracket at

a 60-degree angle to the base. This slant keeps them in place at any normal incline of the drawing board. The lettering instrument lies on the base, with its adjustable front guide pin set into the Phillips-head socket; this props up the pen to prevent ink flow. The grooved block holds a ruling pen or brush.—H. A. Fluchere, Irvington-on-Hudson, N. Y.



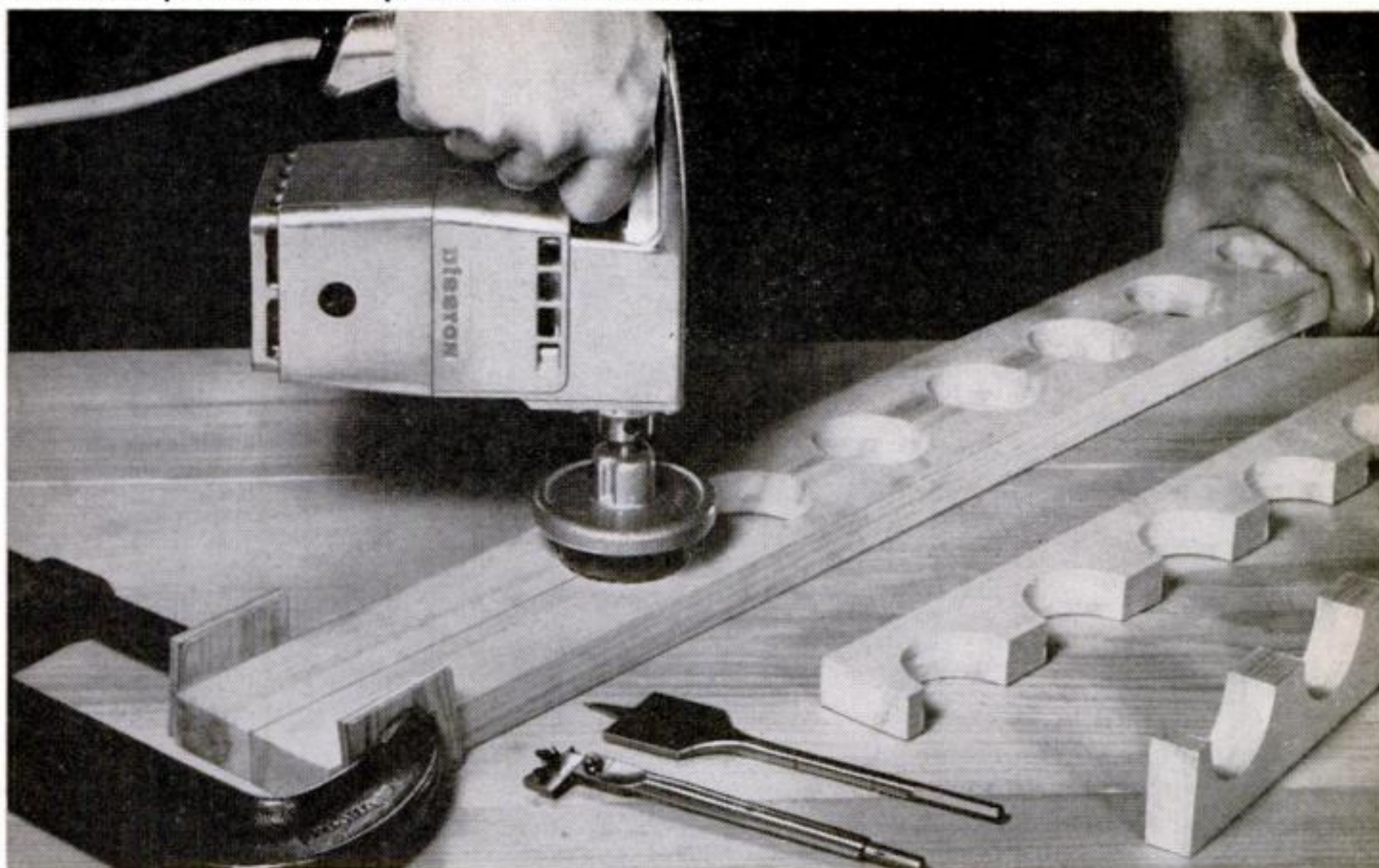
### Shop heater from stacked oil drums

Three discarded oil drums, welded end-to-end, warm my shop. Even on the coldest days, the heater kills the chill in about 10 minutes and has the shop cozy in half an hour. Four drum ends were cut out before welding, leaving closed ends at bottom and top of the stack. Near the top, I cut a hole for a stovepipe exhaust; near the bottom, one to fit the blower of an oil-burning furnace. The jets are adjusted to burn about a gallon of kerosene or diesel fuel an hour.—Wayne Floyd, Fayetteville, Tenn.

▶▶▶The pump on our eight-year-old automatic washer was clogged with lint, but even after I cleaned and lubricated it, the pumping action was sluggish. Then I found that the drain hose had collapsed where it made a 90-degree bend. I wound a 4" piece of coat-hanger wire around a section of garden hose to form a spring. I slipped off this wire coil and inserted it in the drain hose at the bend. Now the pump works like new.—Roy C. Bray, Midwest City, Okla.



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## Amazing Facts About Chains

[Continued from page 101]

all mighty or military. About a fourth of America's 20,000-mile-a-year output is the lightweight bead chain that holds your keys and turns on your reading lamp. Bead chain is one of a large family of power-transmission chains. It is made of hollow metal balls (or tubes) joined by dumbbell-shaped interlinks. In its eight common sizes it has a strength ranging from 18 to 180 pounds. Most popular is the 30-pound ( $\frac{3}{8}$ -inch diameter) pull chain that can switch a light socket 50,000 times. You'll also find it behind the control knobs of many TV, hi-fi, and similar units.

An equally familiar kind of power-transmission chain is the flat-metal one made up of goggle-shaped links blanked out of strip stock. Each blank is laced through openings in the next, then folded over to receive the following link. This allows the chain to lie perfectly flat as it rides over pulleys. In a typical use it takes the place of sash cord. Since it can't fray and has strength to spare, it usually lasts the life of the house. It also adds fire protection because it can't burn through to drop the upper sash and create a fire-fanning draft.

**A flexible gear.** There's another power-transmission chain that you depend on every day, but never see—or hear. It's the toothed silent chain that streaks over your car engine's timing gear at a speed of 1,000 feet a minute. Basically, silent chain is a flexible gear—the fastest kind there is. It is also one of the most durable. The \$5 worth of chain that times your car engine is good for at least a billion turns of the crankshaft.

Roller chain, a fourth major type of flexible power transmitter, is similar to silent chain except that it has rollers instead of teeth between the connecting side plates. Roller chain hit the power-transmission big time with the bicycle. It drove the early cars and trucks, turned the propellers of the Wright brothers' historic plane, and ran one of the first cars to top 200 miles an hour. Though it doesn't run today's cars and planes, it

does run the production lines that make them, and it still turns the wheels of Junior's bike because no better device has been found. The breaking strength of a bicycle chain is a comfortable 1,000 pounds; some industrial power chains take an awesome half-million pounds.

Roller chain also has the distinction of being the finest chain made. One type, used in barometers, altimeters, and similar instruments, is thin enough to thread the eye of a needle. Running over pinhead-size sprockets on an indicator shaft, it converts a .005-inch movement into a pointer swing you can read.

Despite much overlapping of chain types and applications, power-transmission chains are generally regarded as a separate category. They are easily distinguished from the other common types, which are made of wire links. Link stock is called "wire" even when it's as thick as your arm. The way the wire ends are joined leads to two further classifications: welded and weldless.

**Welded chain.** This one does the rough jobs. Its links are bent from lengths of round stock and fused where the tips meet. Small chains (up to  $\frac{3}{4}$ -inch link width) are usually welded electrically; larger ones are fire- or forge-welded by the old blacksmith method of heating and hammering.

Welded chain is good for pulls up to a quarter of a million pounds, and some of the jobs for which it's used could save your life in emergencies. There's a length of welded chain—and sometimes two—nestled under each end of most railroad cars. One length takes over if the air brakes fail; the other backstops the regular car coupling.

Some chain links are welded at the end, others along one side. The difference is mainly in smoothness rather than strength: A good weld is as strong as the metal itself, no matter where it is located. The way the links are formed, however, does make a difference.

Straight links (made by bending wire into perfectly flat ovals) give a chain



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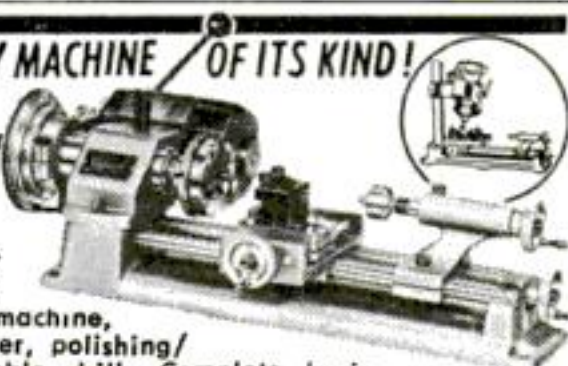
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## Amazing Facts About Chains

maximum strength and flexibility. Twist links (bent up to a uniform angle) let a chain lie flatter. This is desirable when it is to be used, say, over a pulley hoist. Twist links also improve a chain's friction grip.

**Weldless links.** This chain (which includes flat-metal as well as wire-link types) handles the lighter work. The ends of finer wires are frequently looped or knotted so they won't pull open under load. Heavier wires are just bent into closed links. Their holding power, therefore, is limited to the bending—rather than the breaking—strength of the metal. Weldless chain isn't recommended for critical jobs, but don't get the idea that it's a weak sister. In sizes small enough for a watch chain, it can lift about a quarter of a ton; larger versions are good for a two-ton pull.

Regardless of type, a chain's strength and uses vary with the metal of which it is made and the proportions of its links. Special metals and finishes resist attack by heat, acids, corrosion, and most other known hazards. One metal, known as Hatfield's alloy, is so nonmagnetic it qualifies for use on the Navy's wood-hulled minesweepers.

Although chains are made in a fantastic range of sizes and styles, wire-link proportions are fairly standard. In some cases standards have almost the force of law. For stud-link anchor chain, for example, Lloyd's and the American Bureau of Shipping set maximum link length at six times the wire diameter; the outside width of any link can't be more than about 3½ times the diameter. Short links increase a chain's strength and flexibility.

Short links also reduce a chain's tendency to stretch. This may not seem much of a problem now, but old-time sea captains could be pretty fussy about chain stretch. They used anchor chain to measure ocean depth and chart channels. A 90-foot length was called a "shot," and the measure is still used in the anchor-chain trade.

Chain was also used for measuring by



### Amazing Facts About Chains

early land surveyors, and repercussions of the stretch problem are still being felt today. Much of the old city of Philadelphia (among others) was laid out with a worn and overlength chain that has led to some complicated lawsuits. To settle disputes about whose land ends where, Philadelphia keeps a special rule in the city vault. It is precisely as inaccurate as the original chain.

**When you buy.** Hardware-store sales of common sizes of chain for homeowner jobs account for an estimated 50 million feet a year. If you're in the market for any of that footage, remember you can't judge chain strength by appearance. Because of differences in alloys, the breaking strength of look-alike chains may vary by more than 100 percent. When strength is important, make your selection on the basis of manufacturers' listings.

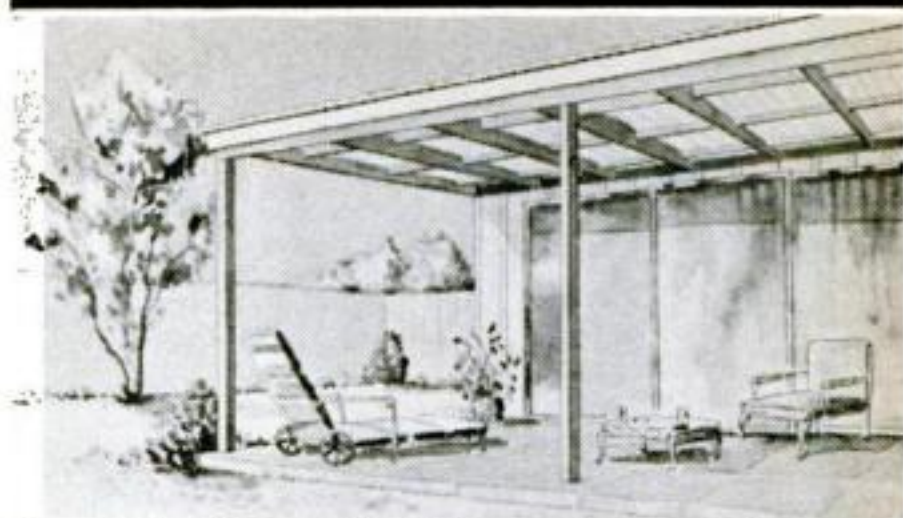
Galvanized chain is usually a good bet in the smaller sizes you might use—say, as a driveway barrier or for mooring your outboard runabout. In larger sizes (from about 3/8-inch wire diameter) galvanizing doesn't greatly increase a chain's life span because normal corrosion is small in depth in relation to the thickness of the wire.

Any time you need a lot of chain, it could pay you to look for used or reconditioned stock. Size for size, it costs about half as much as new chain. Boatyards are a good source.

If you use mooring chain, one way to make it last longer is to reverse it each season, end for end. This equalizes the wear between the portion that rests on the bottom and the busier links that absorb the boat's motion.

And afloat or ashore, you can get better mileage out of any chain by avoiding impact loads. A chain that could easily tow your car may snap if you set off with a jerk. If it does, you lose a good chain; if it doesn't, you may lose a bumper. This could be an expensive way of proving that a chain's weakest link is a lot stronger than it looks. ■ ■

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### Umbrellas Are Back . . . for Picture Taking

[Continued from page 70]

and you could set up a single umbrella with only a 375-watter in it, 10 feet from the subject, and shoot at the snapshot speed of 1/25 at f:4.5. Moreover, your subject could range all the way across the end of a living room without ever moving out of the light—important if you're making movies.

To get equal uniformity, a typical 12-inch reflector with photoflood would have to be about 20 feet away, and it would produce less illumination from its 500 watts than you'd get from the 375 watts of umbrella-bounced light.

*Want to try bounce lighting*, without making an investment in equipment? You can improvise your own reflector by spreading one large-size spray can of aluminum paint evenly, in several coats, over the inside of an ordinary umbrella. Buy a lamp harp, socket, threaded tube, and adapters to mount a reflector flood on the end of the cutoff umbrella handle. Don't expect, of course, the performance you'd get from a scientifically designed commercial unit.

The Reflectal surface is DuPont Mylar film, coated with aluminum in embossed diamond facets—a material similar to the covering on the Echo I Satellite. This is then bonded to nylon fabric. The 36" size utilizes both faces: If you want still softer light than the aluminum provides, you flip the frame inside-out and use the now-concave white nylon surface.

*Lighting Darkest Africa*. You can detach the light and carry the collapsed umbrella with you for "location" shooting. Angled toward the sun, it makes an effective shadow-chaser outdoors. TV cameramen recently took Northlights into the Congo, hoping to bounce light into the dim jungle depths. But the weather turned sour, and for days the umbrellas served to keep camera crews dry. Then the sun burst forth, broiling hot, and for additional days, they sat cucumber cool in the shade of these heat-reflecting canopies. Here were applications even Jerry Johnson hadn't thought of. ■ ■



## Satellite to Put Europe on TV

[Continued from page 73]

transmitted. The higher the relay station is off the ground, the greater the distance it can cover. To send a microwave beam across the Atlantic, you need a relay station on a straight line of sight from both Europe and America. There's only one way—with a satellite.

But a satellite moves fast, and its orbit shifts relative to ground points. Telstar will circle the earth at 16,000 m.p.h. at a 45-degree angle to the equator. On several of its eight daily passes, it will cross the Atlantic far to the south—completely out of our view. At best, it will stay in the Europe-America line for 50 minutes. Even then, transatlantic telecasts will be limited to about 10 minutes each because that's the power limit of its batteries before solar recharging. To get around these limitations, a full-scale commercial system of intercontinental communication would require 20 to 50 satellites, all circling the globe at the same time. Such a system is planned to be in orbit by 1967.

**A first for TV.** Several test communications satellites have been orbited before, but Telstar will be the first to handle regular TV shows. It will also carry telephone and telegraph traffic and make scientific measurements.

Telstar, built by A.T.&T., will be launched from Cape Canaveral by Douglas' three-stage Delta rocket. The company paid the Government \$3,000,000 for the one-way fare into orbit—with no guarantee of safe arrival. The orbit is planned to keep Telstar circling the earth for a long time, but the solar-power cells—despite their protective covering of clear sapphire—will gradually be knocked out by meteors and particles from the radiation belts. In a year their output will drop from 15 to 11½ watts. After two years an automatic timer will cut off the continuously operating beacon transmitter (so its frequency can be used for other things). The remaining equipment will be turned on and off, as needed, by ground signals. ■ ■

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modern, high-quality tuners) you can use practically any adapter designed for wide-band.

Suppose, on the other hand, your tuner was built five years ago and has a narrow band pass. It still may produce good stereo if used with the right kind of adapter. The manufacturer, in fact, may have designed an adapter to compensate exactly for the tuner's narrow channel.

The difficulty comes when you try to use an uncompensated adapter with this tuner. You can also get into trouble using an adapter that *has* been compensated with a wide-band tuner that needs no compensation.

No tuner at all? Getting a new one makes it easier. Buy one with an adapter already built in. You'll get more for your money. It costs the manufacturer more to build a separate adapter than to build it in from scratch.

**Before you buy.** What do you watch for in buying an integrated tuner? The following general rules won't guarantee your getting the hottest tuner in town, but they should keep you from going too far wrong:

1. Find a cold set in the dealer's showroom. Turn it on and quickly tune in a weak station. Turn off the set's AFC (automatic frequency control), if it has one. With some units, you may have to keep retuning for 15 minutes or a half-hour to keep the set accurately tuned to the station. Highly stable sets, on the other hand, can be tuned in as soon as they warm up and won't have to be touched again. The more stable, the better. As a tuner drifts off the station, distortion and noise increase, particularly in stereo.

2. Tune in a weak station on several different sets. To make the test fair, hook each in turn to the same antenna. A really good tuner will give a clean, noise-free signal on a station that another might hardly receive at all.

3. Tune in several stations in sequence. Does the dial work easily? Are

stations easy to tune in clearly? If there is a tuning indicator—eye tube or meter—is it easy to see, read, and use?

4. Ask the salesman if the unit is okay for use with a stereo tape recorder, whether you have one or not. You may get one some day. The multiplex adapter circuit produces a signal at 38,000 c.p.s. This is close to the frequency of the oscillator used in many tape recorders to generate a signal in the recording process. These two signals—the 38-kc. adapter signal and the one generated in the recorder—can get mixed up and put a squeal on the tape you're recording. Most manufacturers have now designed their circuits to prevent this. Be sure a unit you're considering has this provision.

**Getting the most from multiplex.** An antenna setup that pulls in regular FM like a magnet may be okay for multiplex, too—or it may produce FM stereo that makes a symphony orchestra sound like a coffee grinder with a cold.

One Long Island station reported that more than 95 percent of all calls complaining of poor reception were traced to poor antenna setups. The basic trouble: Packing two signals into one FM wave soaks up station power. So the signal you get is weaker. Your old antenna, good enough for mono, may not do the job on stereo. Also, stereo—like TV—is sensitive to ghosts.

Engineers call ghosts—TV or FM—multipath distortion. One signal path goes directly from the transmitter to your antenna. Another bounces from a hill or building before it is picked up by your antenna. It takes the second signal a little longer. On TV, this delayed image appears as a separate picture—a ghost. In stereo FM, ghosts cause distortion. About the only cure—in either case—is a directional antenna.

Because of ghosts, nondirectional antennas often used for FM—turnstiles and "S"s—usually don't work very well on stereo. Your television antenna may do the job if you live fairly close to the



## What to Know About FM Stereo

FM station. If you hook your FM into the television antenna, though, be sure to use an isolation coupler; it costs a buck or two at any radio-supply house.

In many cases, though, you will need a completely separate, highly directional antenna. If you listen to several stations that lie in different directions, you may also need an antenna rotor.

**Tuning can be a problem.** This trick, suggested by WDHA in Dover, N.J., may be of help: Find a station transmitting a signal over one channel at a time. Some stations do this regularly so listeners can check their sets. When a signal comes over the left channel, disconnect the left speaker. Theoretically, no sound should come over the still-connected right speaker, but in practice a little does leak through. Now tune the set and you should find two spots on the dial, not far apart, where the residual signal is the loudest. Between these loud spots will be a quiet area—a null. Tune for the null, and you're on the button.

**Another unexpected trouble.** Some stereo adapters have a stereo beacon, to show when the station is transmitting in stereo.

One night, shortly after WLIR in Garden City, N.Y., had gone on the air with stereo, chief engineer John Rieger answered the phone. It was a listener with a complaint. "The stereo's not too good," he said. "In fact, it sounds just like mono."

"That's because it is mono," said Rieger. "We're not broadcasting in stereo now."

"Then why is my stereo beacon on?"

"It will go off in a moment," said Rieger, realizing what had happened. Because the station engineers hadn't had time to install a switch, they simply turned off the special stereo-signal generator by pulling out the crystal. But sometimes they forgot.

Rieger walked back to the unit, pulled the crystal. The phone rang. "How did you do that?" asked an incredulous voice at the other end. ■ ■

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cold or pneumonia. It treats the new tissue like a disease.

Embryonic tissue is different. It all but lacks antigens. Using it as a graft source, Dr. Petrucci has had exciting results: In one case he transplanted an embryonic pituitary gland to a 29-year-old woman whose own pituitary gland was wasting away. She weighed 64 pounds and had no teeth or hair. Some eight months later, the patient had gained 11 pounds, showed a rise in blood sugar, and was growing some hair.

In another instance, Dr. Petrucci grafted a piece of embryonic skin to the back of his own left hand. He extended his hand to show me the spot, pleased with how perfectly the graft had taken. While it was lighter and pinker than the surrounding tissue, the area had the same pattern as the rest of his skin.

**The "biological cradle."** These operations were the first that Petrucci was able to perform to test his theories. Behind them lay years of research to perfect a method of growing the embryos themselves. This is not the relatively simple tissue culture where highly specialized cells like bone marrow or liver are kept growing in glass dishes fed by nutrient broths. Instead, this is growing a *whole* organism starting from scratch: taking the microscopic human egg cell (about .004 inches in diameter) and attempting, against long odds, to fertilize it and keep it alive for a long time.

A few pioneers, like Dr. John Rock of Harvard and Dr. Landrum Shettles of Columbia University, have also accomplished this—for a few days. Dr. Petrucci, working with Drs. Laura di Pauli and Raffaele Bernabeo, has done it over a two-month period.

Dr. Petrucci believes his success lies in following nature closely. Like an engineer taking account of many variables—temperature, pressure, light, oxygen level, and delicate chemical balance—he has tried to build a working model of the environment in which an embryo normally develops within the uterus.

The ova he uses come from women patients who are undergoing surgery—usually for the removal of the uterus. The operation is timed to come 13 or 14 days after the last menstrual period, to insure that the ovum is ripe. The sperm come from men tested for sterility.

The ovum is washed and placed between chamois disks. These are the lab substitute for the uterine wall where the egg normally nests, and for the placenta—the membrane sac that encloses the embryo and acts as a filter for its food and oxygen.

**Life begins.** A bath of sperm is introduced between the disks. With luck, a sperm penetrates the egg and joins the nucleus. With this union, life begins.

The cell can now divide and grow—under the right conditions. It is here that Dr. Petrucci's engineering gets impressively intricate. The egg-disk setup is sealed in a transparent plastic container—the "biological cradle"—and kept precisely at body temperature. I saw a variety of these in Petrucci's lab—small ones for one- or two-day experiments, larger ones for lab embryos to be allowed longer development.

A tube leading into the top of the cradle bathes the egg with food in the form of plasma—the liquid part of the blood. Dr. Petrucci pools the plasma from a number of pregnant women who are at approximately the same stage of pregnancy as the lab embryo. The plasma is mixed with oxygen and fluid from the uterus and introduced a drop at a time at a rate that simulates the normal pulsing of an artery. It circulates two or three times—until the waste level gets too high—and then is drained off through a tube at the bottom, this time at a rate to match a vein's flow. Pressure and temperature gauges check the process.

**Early failures.** Dr. Petrucci's earlier and less refined attempts failed. In one case, he explained, the mixture used to seal the cradle contained chloroform that hadn't quite dried. The egg was anesthetized. Another time, a fertilized



**Now We're Growing Human Life in the Lab**  
ovum had started to divide but showed no specialization—it was just a monstrous blob. Dr. Petrucci theorized that this might have been caused by light, especially the ultraviolet band. So now light is excluded—as in the uterus.

But Dr. Petrucci still needed a film record. He now photographs the growing embryo on infrared film through an ingenious arrangement of movie camera and microscope.

The photograph at the beginning of this article is a still from such a film. Earlier the camera had clocked these events in the life of this 58-day-old embryo:

*The first week.* In the first 72 hours after fertilization the egg split and divided to produce 2,4,8,16, in series, daughter cells. By the end of the first week, however, the first great cell population explosion had taken place. The mass of cells had begun to differentiate into the three layers that would eventually become skin and bone, muscle, and internal organs. (Exactly the same thing takes place in a mother's body during this time, except that the egg isn't stationary. It takes a week to move up and attach itself to the wall of the uterus.)

By the end of the third week the first signs of the embryo's brain and spinal cord—a "neural tube"—appeared. Several days later the "somitic period" began—when the organs start to show up. At 30 days the embryo was about 1/5 inch long and growing at a rate of 1/25 inch a day. Five quarts of plasma had been used up.

At the 58th day the embryo was 1 1/5 inches long. Its heart was beating and the camera could follow the coursing of blood vessels. Dr. Petrucci decided to stop the experiment. His reasons? For one, the embryo was consuming over a gallon of plasma a day. At this increasing rate, further development would require thousands of quarts of plasma as well as elaborate means of controlling the embryo's breathing and digestive functions. But his main reason was that the glands and other tissues were suffi-

CONTINUED

187

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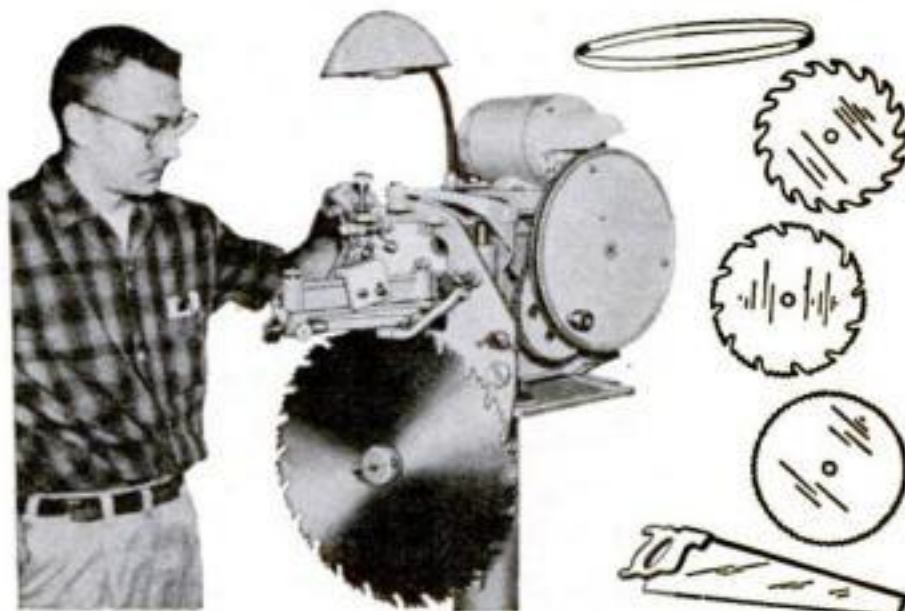
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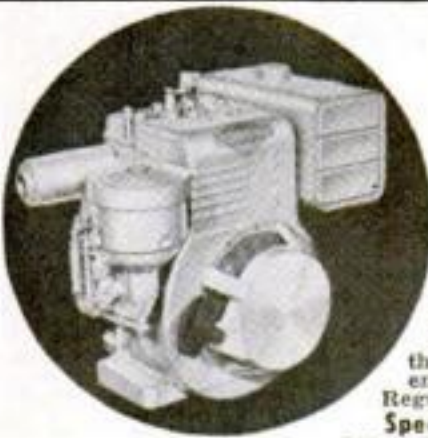
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ciently developed to consider their use as transplants.

Naturally the tissues were not exact replicas of mature parts. The pituitary he transplanted, for example, was the "Rathke's pouch"—a microscopic but still identifiable pit on the back of the embryo that contains the rudimentary gland. The idea was that it would take root in the patient's body and build itself into her circulatory system.

*Logical enough.* Yet when Dr. Petrucci first announced his research (he showed the films) the idea of transplants got lost in a wave of attacks in which he was accused of playing God or Frankenstein. The idea of having a live embryo around "under glass" was disquieting to many people.

It opens the door, nevertheless, to research that could reap even more dramatic results than transplants. Take the question of fertilization itself. Why does one particular sperm succeed in getting into the egg? Is it naturally superior? Is there a difference in shape between sperm that carry the x (male-producing) chromosome and the y (female-producing)? This is one of the hottest debates in genetics today, and further camera work might settle it.

Dr. Petrucci hasn't publicly taken sides in this dispute. He feels, though, that there may be ways of altering temperature or adding chemicals to a sperm bath that will change the odds of an egg being fertilized by one or the other kind.

*Russians are interested.* Some Soviet embryologists speculate this way, too. A number of specialists, impressed by Dr. Petrucci's techniques, are developing lab-grown embryos on their own—with definite economic aims in mind. If they could find a cheap and easy way of sex-determination in animals, they could produce more cows than bulls, sleeker and softer-pelted male minks or sables, and worms spinning finer silk.

But apply this to man and it's easy to see how Petrucci's dramatic work triggers controversy.

To his critics the doctor replies that



### Now We're Growing Human Life in the Lab

he had long ago weighed the ethical issues involved. A religious person himself (a Catholic), he insists he has never had a desire to "create babies." His primary aim, he assured me, has been to develop transplantable tissue.

Many respected scientists back him in this. In fact, his method may increase the chances of a successful graft in ways that involve more than the use of tissue that is low in antigens. To understand why, first consider what is involved in a two-way exchange of living tissue:

**Immunity.** Some scientists believe that you inherit a kind of immunological "code" from your parents. The code determines what infections you are susceptible to, what kind of antibodies you build. Yet the code sees to it that these defense mechanisms don't go berserk and turn against the rest of you.

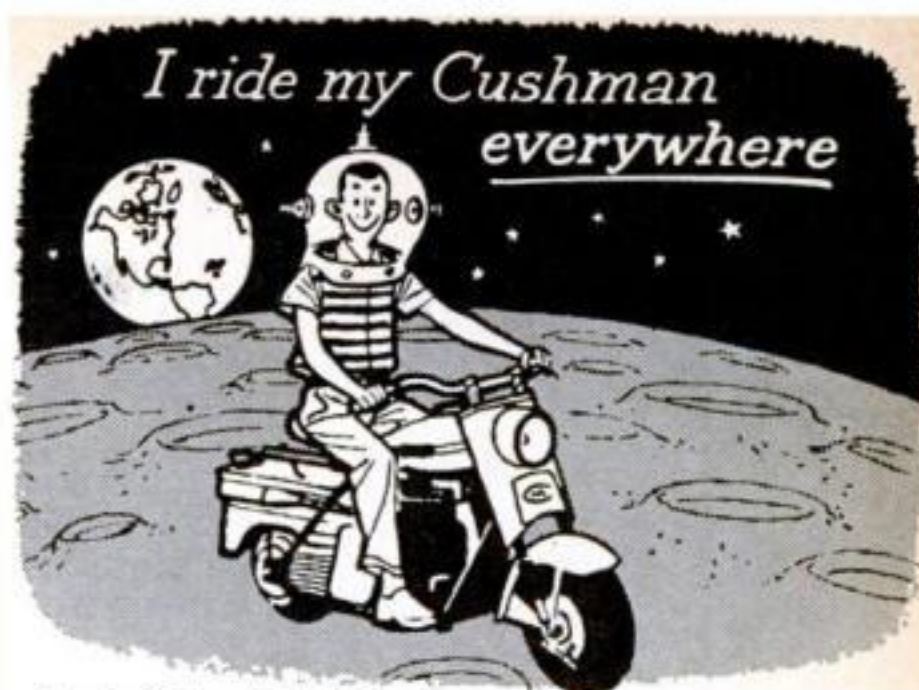
The result is that you "tolerate" your own empire of cells, but are "immune" to an outsider's. With one exception: the pregnant woman. Fortunately, in most cases, she tolerates the embryo inside her, even though half of it—the genetic contribution of the father—is foreign.

Not only is the embryo tolerated, but Petrucci and others believe that during this time when embryo and host live together, a kind of learning process goes on during which an immunological "memory" is developed.

**Antibodies from plasma.** But when there is no host, there is no "memory." And by letting an embryo develop from plasma (which contains antibodies) drawn from a pool of hosts, the chances are the embryo would be kept neutral.

More: If, before it is transplanted, the embryonic tissue were washed of its regular plasma supply and irrigated instead by the plasma from the new host's body, it might perfectly suit the new host.

Dr. Petrucci is convinced this should work. Undaunted by the furor, he intends to continue his research. There will be more lab-grown embryos, he assures me, but probably less said about them—for a while. ■ ■



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## Multiply Your Muscle Power

[Continued from page 97]

The all-around tool for applying the screw principle is the bell-bottom jackscrew. Small versions have a capacity of about five tons, adjust from 8" to 13", cost about \$5. For two to three times that money, you can get a 20-tonner.

You get the working element of a jackscrew when you buy an all-purpose jack. One weighing less than five pounds and costing about \$3 will lift 5,000 pounds and support twice that weight.

To work in a tight space, simply prop an all-purpose jack on a bit of four-by-four lumber. Or set one atop a length of heavy (3" or 3½") pipe to make a jack of whatever height you need.

If you don't want to invest in special equipment, dig your bumper jack out of the car trunk. Run a loop of heavy rope or cable across its lift hook and around the load. It'll provide lift enough to pull posts, or hoist heavy objects so you can start rollers under them.

To hold up a beam while you place a post, or to serve as a permanent prop for a floor sagging under a piano or refrigerator, you may need a jack post. Most of them are 6½' to 8' tall, will lift and support 10 to 20 tons. Some can be cut to the exact length you need. Usual price range is \$10 to \$15. There are two special-purpose models: the "shorty," to go under stairs, porches, and crawl spaces; and a tall post designed to be sealed in concrete and left permanently.

**Friction-reducing tricks** will permit you to move things that otherwise would be far out of your weight class.

A broad-bladed shovel—garden or snow—is the handiest friction-cutter for outdoor jobs. For things that won't fit on it, try a gunny sack. The indoor version of this stunt is more familiar: Drag such hefties as automatic washers and stoves around on a scrap of carpet.

Another way to spare yourself is to share the load. If you distribute the weight of any heavy object among several handgrips, you can draft a few helpers. It's the loner who keeps the liniment people in business. ■ ■

## A Homemade Saw for Cutting Big Panels

[Continued from page 113]

Remember to allow for their thickness— $\frac{1}{16}$ " on each side—if you add them. A strip of laminate can also be cemented to the lower panel-support rail for a slipfree surface.

**Rigging the sash balances.** These are notched into the top of the A-frame. For smooth operation, their tapes should line up as near as possible to the face of the slide so the pull is straight.

The balances are controlled by spring tension and must be bought to match the combined weight of the slide and your saw. Together, the two I used support 20 to 23 pounds and are adjustable so you can set the tension exactly. Their model number is 150FT-23, and they're sold by the Caldwell Mfg. Co., 64 Commercial St., Rochester, N. Y. Price is \$4.07 each.

Cutting guides can be added easily by fastening sections of steel measuring tape vertically and horizontally to the frame. Locate the vertical rule with its zero marking at the upper edge of a 4'-wide panel. A pointer fastened to the saw slide in line with the blade shows you where to set the saw for rip cuts. For crosscuts, fasten the horizontal rule to the lower support rail. Put its zero marking at the edge of the saw kerf that's on the *outside* of the blade (away from the motor). This way, all cuts will be true, automatically allowing for the width of the kerf.

When cutting near the end of a long panel, block up the other end temporarily to keep it from tipping off the support rail. On rip cuts, you'll also need a way to keep the saw running while you feed the work through. Where there's no trigger lock, tape the trigger closed and control the saw by connecting or disconnecting the power cord. ■ ■

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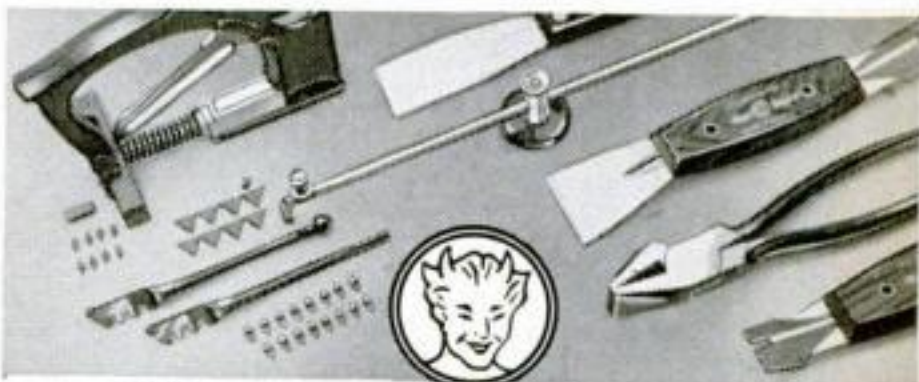


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## Working with Canvas

[Continued from page 118]

sign of your boat will determine your seam plan. With a beam under 54" and no windshield, yard-wide duck allows margin for a single centerline seam.

Soak new fabric and let it dry. Stitch the seam and lay joined pieces over the boat. With the cover held mildly taut by weights or pushpins, mark the gunwale outline on the canvas. Trim outside the line allowing 4½" on each side for three-layer 1½" hems, plus 2½" on each side and 5" at the transom, for pullover and wet shrinkage.

After hemming, trial-fit the cover dry. If okay, soak it half an hour and put it back on the boat thoroughly wet. Hold it taut with weights or pushpins and punch holes in the hem for fasteners. Mark the hull through these holes with a soft pencil to locate the fastener studs. Pull short strings through the holes in the hem so you will be able to find them easily after you have removed the cover to add the fasteners. You can screw fastener studs into wooden hulls, but you'll have to drill hulls of metal and plastic and use nut-and-bolt studs. Beamy boats with windshields call for crosswise seams. Procedure is generally the same as above except for a trial fitting with the seams pinned. With the cover sections laid out on the boat, start by pinning a seam across the top of the windshield and work toward the ends.

**Trailer covers.** Since small luggage-trailer covers are usually "boxed," you must allow for shrinkage before cutting your top panel. The safest way: Wet and dry new canvas, make a heavy pencil mark 10' from one end, resoak and measure shrinkage with the canvas thoroughly wet.

Don't be surprised if you've lost a few inches. Use this measurement to make a proportional shrinkage allowance. Leave an easy margin. A cover that's too tight to go on when wet is also too tight to take off after a rain.

**Canvas care.** After salt-water use, rinse thoroughly in fresh water before storing. Salt left in the fibers absorbs moisture from the air and causes mildew. Darn any rips at once to prevent spreading and patch at the first opportunity. If you must wash a cover, use as little soap as possible. If it loses its water resistance, re-treat it with spray-on or brush-on dressing. Always dry canvas thoroughly before folding and storing.—George Daniels.

## How the Camera Catches Crooks

[Continued from page 54]

Said Tuttle, "It didn't even take a piece of cheese to bait the trap."

During the seminars he holds for police, Tuttle brings his students up to date on the latest in law-enforcement photographic equipment. He also shows how even the simplest equipment—used with special techniques—can nail crooks. There was the case of the man in California who took out two \$10,000 double-indemnity insurance policies, one on his wife, another on a boarder. A few weeks later, he drove his car—containing wife and boarder—over a cliff. He jumped out just in time. He told police his brakes failed.

The insurance company pulled the car out of the ravine, checked the brakes, found them good. Cops were suspicious, but it looked as if there'd be no way of proving him guilty. But one tiny clue tripped him up.

**Hidden writing.** While searching the man's house, police turned up a small blank pad. There was a faint impression on it, made when a sheet above had been written on, then torn off.

At the crime laboratory, the pad was put through a procedure that Tuttle has helped develop. It was photographed on high-contrast film while a strong beam of light was aimed across its surface to make every irregularity stand out. The writing revealed was enough to convict the murderer. Before the "accident" he had written the amount of insurance he would receive: \$40,000. He was 55 years old, so could not start receiving social security for another 10 years. On the pad, he had figured how much he could spend each month if the \$40,000 was to last until he started collecting social security at 65.

Tuttle has worked most of his life to help catch and convict criminals, but he's always delighted to use his talents to clear the innocent. One case began when a sailor stationed in San Diego, Calif., went to San José to visit his girl friend. Short of cash, he hocked his movie camera.



### How the Camera Catches Crooks

A few days later, police making a routine check of pawnshops saw the camera, noted that it looked like one reported stolen. The woman whose camera had been lifted identified it as hers, and the police at San Diego arrested the sailor.

The young sailor wrote Kodak, asking if any record was kept of serial numbers. Unfortunately, no such record is kept. Tuttle, though, had an idea. He wrote the San José police suggesting a plan. "Buy a roll of film for the camera," he said, "and shoot some pictures. Then get the last roll the sailor shot, and the last roll the woman shot. Make enlargements of several frames from each roll."

Tuttle went on to explain that the masking frame of every camera leaves a pattern as distinctive as a fingerprint. Tiny bits of dirt, nicks, burrs, and other irregularities in the frame are imprinted indelibly on every inch of film. "By comparing the masking-frame patterns from the sailor's and the woman's films, you can easily tell whose camera it is," he wrote. Police made the test and released the sailor.

*Scare power, too.* Sometimes just the thought of photography can scare a criminal into giving up. I was present at one of Tuttle's seminars recently when he told officer-students of this case. One afternoon a few years ago in Cleveland, a holdup man walked into a bank and made off with \$17,000. A few days before, however, the bank had installed a movie camera that could be set off by pressing a button. The entire holdup was photographed.

Only one thing went wrong. Since the camera covered the entire bank, individuals in the picture were small and unrecognizable. Nevertheless, the scheme caused a sensation. Bank officers released the film, and that night millions of Americans saw the robbery on television news programs.

The bandit, meanwhile, had hopped a bus to Indianapolis. Shortly after the newscast—which he had not seen—he

CONTINUED

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### How the Camera Catches Crooks

was in a restaurant when a man came running in. "Just now on TV," the excited man said, "they showed movies of a real bank robbery in Cleveland this afternoon. You could actually see the guy robbing the bank."

The holdup man was jolted. He got on a bus, went back to Cleveland, and surrendered, never realizing that the pictures were not clear enough to identify him.

Since then, such bank photography techniques have been improved.

**The hidden lens.** Unfortunately, photography is not always on the side of the law. Tuttle told me of one case where a smart yegg had cracked a safe with photographic help. It started one morning when a supermarket manager in a New Jersey town opened the safe for the start of the day's business. Unknown to him, a hoodlum had pulled up in front of the store in a panel truck. While the manager opened the safe, kept near the front window for safety, the cracksman was in the back of the truck with a high-powered telephoto lens and movie camera, photographing the combination.

That night he broke into the store, opened the safe, and made off with the cash. The store manager, during questioning, remembered the panel truck, and police figured out what might have happened. When the same truck pulled up in front of another supermarket one morning a few months later, the alerted manager called the cops. They got their man.

**Movies "mug" drunken drivers.** Movies, though, are more often on the side of the law. A big problem in drunken

driving is getting convictions. It frequently boils down to a suspect's word against an officer's, and most judges are loath to convict without definite proof.

Police get around this now in a score of cities by making each suspect the star of a two-minute movie, frequently in sound and color. While the camera grinds away, the arrested driver has to walk a straight line, pick up a dime, stand on one foot. One town, after installing the system, got 99 guilty pleas out of the first 100 arrests.

"It's amazing what happens when they come back the next day—sober—and see the film," Tuttle said. "One man here in Rochester, for example, showed up with his wife on one side, attorney on the other. He was muttering about suits for false arrest. The police sat them down, put on the film. After 30 seconds, his wife jumped up, hit him over the head with her umbrella, and stomped out. The man entered a guilty plea."

**A teacher is wrong.** Not all of Tuttle's activities are concerned with criminals. A small boy in Rochester was accused by his teacher of changing some minus signs on his report card to pluses. The boy's grandfather, a friend of Tuttle's, brought the card to the criminologist. Tuttle photographed the allegedly altered plus signs greatly magnified, and at an angle. The result showed clearly that the vertical strokes had been made first, and the horizontal strokes on top of them. Had a minus been changed to a plus, the lines would have been in the other order. The teacher, shown the evidence, admitted that she must have made a mistake. ■ ■

### Numbers in the round

An 80-year-old cylindrical slide rule is used for calculations by Robert A. Best (right), an engineer at Lockheed's Missiles and Space Division, Sunnyvale, Calif. Although the company uses intricate electronic computer equipment, he likes the old-timer and says it's the equivalent of a slide rule 30 feet long. It gives results to five digits.





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## USE THIS HANDY INDEX TO FIND WHAT YOU WANT

Advertising, Agencies for Advertisers...	53
Agents Wanted .....	43
Air Conditioning .....	7A
Antiques, Relics & Indian Goods.....	29
Art Instruction, Cartooning, Sign Painting .....	54
Astronautics .....	5A
Authors Service .....	52
Auto Supplies & Equipment.....	2
Auto Trailers .....	3
Automobiles & Midget Cars.....	1
Aviation .....	5
Boats, Outboard Motors.....	11
Body-Building Courses, Jiu Jitsu, Etc.....	12
Books & Magazines .....	23
Business Opportunities .....	37
Buy It Wholesale.....	38A
Cameras, Photo Supplies.....	34
Camping Equipment & Tents.....	16
Coins & Currency.....	26
Color Photo Finishing.....	32A
Detectives .....	47
Diving Equipment & Training.....	15A
Do-It-Yourself .....	66
Dogs, Birds, Hamsters & Pets.....	17
Earthworms, Crickets, Frogs.....	18
Educational & Instruction.....	45
Electric Trains .....	64B
Electrical Supplies & Equipment.....	7
Employment Information .....	42
Engineering Services .....	60A
Engines, Motors, Etc.....	10
Farms, Other Real Estate.....	19
Field Glasses, Telescopes.....	14
Foods .....	71A
For Inventors .....	60
For Sale Miscellaneous.....	71
Formulas, Plans, Etc.....	39
Gifts .....	49
Government Surplus .....	11A
High-Grade Salesmen .....	44
Hobbies, Collections .....	31
Home Craftsman .....	65
Hypnotism .....	24
Import-Export .....	38B
Inventions Wanted .....	61
Jokes, Games, Novelties, Etc.....	24A
Key Machines .....	9C
Language Outfits .....	48
Loans By Mail.....	80B
Machinery, Tool Supplies, Etc.....	9
Magic Tricks, Puzzles, Etc.....	25
Minerals & Precious Stones.....	30
Miscellaneous .....	79
Models, Model Supplies.....	64
Money-making Opportunities .....	38
Motion Pictures & Color Slides.....	33
Motorcycles, Bicycles & Supplies.....	4
Musical Instruments and Song Writers.....	35
Of Interest To Women.....	70
Old Gold, Jewelry, Watches.....	67
Personal .....	80
Phonograph Records .....	35A
Photo Finishing, Photocopies, Etc.....	32
Plastics .....	40
Printing, Multigraphing, Etc.....	57
Printing Outfits, Supplies.....	58
Profitable Occupations .....	22
Radio, TV, Electronics, Hi-Fi.....	36
Razor Blades, Shavers.....	74
Remailing Service .....	80A
Rubber Stamps & Office Supplies.....	56
Science & Chemistry.....	41
Special Services .....	51
Sporting Goods, Guns, Fishing Tackle, Etc.....	15
Stamp Collecting .....	28
Tattooing Supplies .....	75
Travel Trailer Rentals.....	3A
Treasure Finders & Geiger Counters.....	77
Wanted to Buy.....	72
Watch Repairing .....	78
Wearing Apparel .....	73
Welding, Soldering .....	8
Western Merchandise .....	79A

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chance of shock when working around wet grass and bushes.

Meanwhile, manufacturers are also eyeing the industrial possibilities of cordless power. Black & Decker has already extended its battery line to include several husky drills designed for construction and maintenance workers who may not always have an electrical outlet handy.

Porter-Cable's first entry in the battery field will also be, significantly, a line of heavy-duty drills. The Gardner-Denver Co. in Quincy, Ill., has just announced the first battery-powered wire-wrap tool for use by technicians making electrical connections in out-of-the-way places. It takes all standard wire-wrapping bits and will make thousands of connections on a single charge of its removable cell.

The implication is promising: If you can make battery-driven tools powerful enough to satisfy the rugged requirements of professional use, you've got it made. Cordless tools are here to stay.

**Two kinds of power.** Some of the tools you'll see this summer will get their power from tiny rechargeable nickel-cadmium batteries, either built into the tool itself or carried as a separate pack. Of this type, Black & Decker is introducing an unusual double-edged hedge trimmer that cuts in either direction. Skil Corp. is offering a hedge trimmer, grass clipper, and  $\frac{3}{8}$ " drill.

Two other makers have added an interesting new twist. Their machines will be run by conventional 12-volt auto batteries. Exide, working with the Little Wonder tool people, has fashioned a handy wheeled cart that totes a battery anywhere around your yard. From this you can run an electric lawn edger and two sizes of hedge trimmers, all powered by 12-volt motors.

Lambert Inc. has tucked an ordinary car battery under the hood of a 19" rotary mower and come up with a virtually silent machine. Its motor puts out  $\frac{1}{2}$  hp. at 3,000 r.p.m., said to be comparable in cutting torque to a 2½-hp. gasoline mower. It also has an ingenious cutting-height control. Instead of fussing with the wheels, you merely raise or lower the entire blade-and-motor assembly with a lever on the mower's handle.

Both the mower and Exide's battery toter have a built-in charger to renew the battery. When the tools aren't in use, you park them

with the charger plugged into any 115-volt wall outlet. You get a bonus, too. If you're suddenly caught with an ailing car battery, you can use the charger to bring it back to life again.

**How long do they last?** Although admittedly limited in power, cordless tools are proving to be surprisingly capable, especially on yard jobs that need be done only periodically. All of the hedge trimmers will handle several hundred feet of average-size growth on a single charge—far more than you're likely to tackle on a Saturday afternoon.

Lambert's car-battery mower will take care of 14,000 square feet of lawn at a time—or about two good-sized lots. Recharging takes only 12 hours on all of the tools, so you can put them to bed for the night and have them ready to go next morning.

To extend the usefulness of its tools, Black & Decker has also added a new wrinkle this season. Unlike its earlier drill, which contained a fixed battery, the new hedge trimmer and industrial drills will have interchangeable cells that can be slipped in and out like an oversize flashlight battery. When one cell is used up, you can take it out, insert a new one, and keep right on working. There's also a new dual charger that handles two batteries at a time so you always have a freshly charged spare ready for use.

Skil and Porter-Cable use a slightly different system. Their tools are powered from a separate battery pack that you carry at your waist. You buy only one pack and can plug any of the tools into it as needed. You can also run the tools off any 12-volt car or boat battery by using a special cord that clips to the battery's terminals. Both Skil and Porter-Cable are planning additional tools for the future that will be powered in the same way.

**How much do you pay?** Cordless power is still something of a luxury. Manufacturers are quick to point out, however, that the cost goes down as you add future tools since, in many cases, you buy the basic battery and charger unit only once. After that, new purchases ride free.

You also pay a certain premium for convenience. You pick up a tool, walk to the farthest corner of the north 40, flick a switch, and—buzz—the job is done. And that, makers figure, is worth it. ■ ■



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